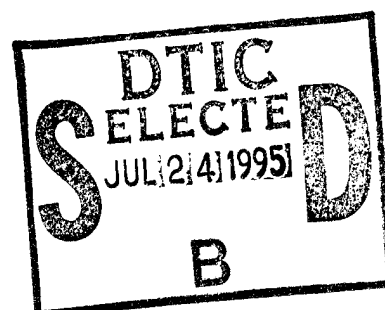


NAVAL POSTGRADUATE SCHOOL MONTEREY, CALIFORNIA



THESIS

**DEVELOPMENT OF A PROTOTYPE
FOR AUTOMATING
TOTAL QUALITY LEADERSHIP (TQL)
TRAINING**

by

Joyce A. Wiseman

March, 1995

Principal Advisor:
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by

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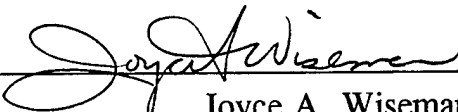
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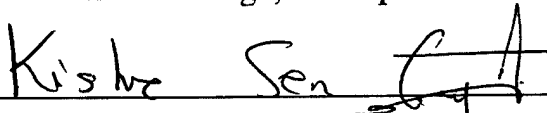
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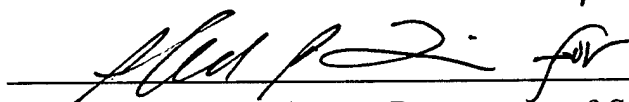
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ABSTRACT

Despite the personnel downsizing and budget cuts, the Department of the Navy must continue to train the critical mass in order to achieve the Total Quality Leadership (TQL) transformation as desired and mandated. A computerized training module designed to help instructors provide just-in-time, individual training in the TQL principles could assist the Navy in achieving its TQL goals more efficiently, thereby saving time, money, and personnel.

This thesis describes the design and development of such a prototype. The "TQL Trainer" was created using an authoring software construction set called Toolbook, and material from Lesson 1 of the Department of the Navy's Fundamentals of TQL (CIN P-500-0012) course manual. Design considerations included the need to provide instructional, interactive training utilizing multimedia to effect an interesting, multimodal learning experience. Automation, video and audio clips, text blocks, navigational buttons and lesson maps provide the student with an easy to use, effective training package.

The TQL Trainer represents a good model on which to conduct further test and evaluation. It covers the important introductory concepts of TQL, has the ability to test the student's knowledge of the material reviewed, and presents the information in a versatile, multimedia training package which can be utilized to enhance the Navy's TQL training program.

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I. INTRODUCTION

A. PURPOSE OF THESIS.

The purpose of this thesis is to design and develop a computerized Fundamentals of Total Quality Leadership (TQL) training module to be used as an instructor's tool for implementing the Department of the Navy's mandated TQL transformation.

The Naval Postgraduate School offers an ideal opportunity to develop and test a training module of this kind because of the availability of research materials and equipment as well as the variety of students (Navy's top leaders O3 and above) who can provide suggestions as well as acceptance testing of the end product.

B. OBJECTIVE OF THESIS.

The objective is to develop an effective computerized training module for the Department of the Navy's Fundamentals of TQL course, which can be used in conjunction with other available training resources to enhance fleetwide training. Additionally, to be considered effective, the training module must prove to be a valid training resource of its own merit, such that it improves the Navy's ability to implement the required TQL training objectives.

Used as a supplementary tool, the computerized module hereafter called the "TQL Trainer" can help instructors provide more thorough training in the TQL principles in a variety of ways:

- It can be used to introduce new students to TQL principles
- It can be used to reinforce particular classroom subjects such as statistical tools, while permitting the student the ability to experience, on his own time and at his own pace, review of a particularly difficult subject, or missed material.
- It can be used to assist those who benefit from individual, self paced training versus group classroom training.
- It can be used when time and/or manpower limits the command's abilities to provide the traditional "formal" TQL training.
- It can be used by individuals as self-improvement training.
- It can be used by suppliers and external customers to understand the Navy's TQL philosophy in providing closer liaison and improved processes.

By performing effectively in all these ways, the TQL Trainer, used in conjunction with trained instructors, will make it easier for commands to accomplish the critical mass training needed for the TQL transformation to take place.

C. RESEARCH QUESTIONS.

1. Primary Research:

What factors are to be considered in the design and development of a computerized training system for the Department of the Navy to teach the Fundamentals of Total Quality Leadership (TQL)?

2. Secondary Research:

What are the information requirements?

What is the best way of incorporating multimedia features to effect interesting, interactive computerized training?

D. SCOPE OF THE THESIS.

This thesis will include the identification of information requirements, the design and development methodologies used in creating the prototype, and the general principles needed in an interactive, multimedia-capable, instructional system, as well as a subjective evaluation of the completed prototype.

Although authoring tools are becoming more prominent, there is no one proven method for developing an effective training module since the material content, student profile, hardware & software capabilities/limitations are very different from one project to another. This thesis will investigate the wide range of variables pertaining specifically to a TQL-focused tutorial for the Department of the Navy.

Due to the complex nature of developing a training prototype of this kind (40 hours of development work : 1 hour of completed tutorial), it was doubtful from the beginning that a prototype encompassing all 7 lessons would be completed during this thesis project alone; however, the identification of Lesson 1 (Introduction) material, as well as the design features and multimedia possibilities were considered well within the scope of this single project. A brief evaluation of the completed portion as well as considerations for follow-on projects are included in Chapter IV as summary items.

E. METHODOLOGY & LITERATURE REVIEW.

1. Methodology.

In order to develop a training prototype, a thorough knowledge of the subject material, research materials pertaining to the subject content, or use of a subject matter expert is needed. Additionally, since automated training must be structured differently than classroom and correspondence training, a design and development methodology must be utilized to ensure a useable prototype is created which meets its stated objectives. To fulfill both structure and knowledge requirements, all available resources were obtained and reviewed for use in building the prototype.

2. Literature Review.

a. Material Content.

(1) Fundamentals of Total Quality Leadership.

The completed prototype will encompass the Navy's Fundamentals of Total Quality Leadership Student Guide (CIN P-500-0012). This fundamentals course provides the basic information necessary to understand and operationalize Dr. W. Edward Deming's Quality Management philosophy. The course also briefly explains the history of Total Quality and the Navy's reasoning behind supporting its full integration within Department of the Navy (DoN). The course content is austere, including numerous directions to the TQL instructors as to various videos, slides, or exercises which are necessary to enhance the course material. Because the manual is very comprehensive, however, it is used as the primary source of material for this prototype.

(2) Quality Management for Government. (Hunt, 1993) provides an excellent source for guiding TQL implementation within Federal, State, and Local government. He provides supplemental data in support of the Navy's Fundamentals of TQL course, going into greater details where necessary, and providing a broader perspective as to government's use of TQL in their reengineering efforts.

(3) Video tapes. The following tapes pertaining to TQL were viewed for their ability to capture and hold the interest of the audience, terminology and verbiage for use within the prototype, and for a clearer understanding of the course material.

- Customer-Driven Quality (Fortune Magazine Video Seminars)
- TQM (in plain English) by the U.S. Army
- Introduction to TQL by Mare Island Naval Shipyard

b. Design and Development Sources.

(1) Computer-based Instruction. Computer-based Instruction (Alessi, 1991) was selected as the primary source pertaining to design methodology. This book was excellent in explaining the pros and cons of designing computerized training. There are different design methodologies available, depending on the purpose of the computerized system being developed. The model described by Alessi is oriented towards computer delivery of instruction, and includes not only designing a lesson on paper, but the implementation onto a computer and the evaluation of the final product. Alessi's model is empirically based, and incorporates evaluation at several intermediate steps, but remains flexible enough to permit the designer to change the order of the steps, add, or delete steps as necessary. The importance of flowcharts and storyboards were emphasized with numerous examples and a step-by-step process for system development was provided. Alessi's 10 steps form the basis for the design and development of this training prototype.

(2) Systems Analysis & Design Methods.

(Whitten, 1989, p. 416) discusses the advantages and disadvantages of prototyping. User involvement was an important factor in the design and development of the TQL Trainer, and awareness of the following advantages/disadvantages was important to keep in mind throughout the project.

Some of the advantages are:

- encouraging active end-user participation
- allowing iteration and changes throughout the development process
- allowing end-users to see their stated requirements in action, to ensure their needs are being met
- permit errors to be detected early
- increases creativity through quicker user feedback which can lead to better solutions

Some of the disadvantages of prototyping are:

- encourages ill-advised shortcuts through the life cycle
- can solve the wrong problems if survey and study phases are passed over
- many try to prototype without specifications
- some design issues can inadvertently be forgotten

- the scope and complexity of the proposed system can quickly expand beyond original plans during prototyping
- can reduce creativity when developers are merely incorporating reports and forms into the prototype, rather than finding better ways
- slower performance than many 3rd generation programming systems

(3) Multimedia Interface Design. (Blattner & Dannenberg, 1992) provided guidance in describing multimedia, interactive, instructional systems through its many examples of similar systems. The TQL Trainer is described in Chapter III of this thesis much the same way as Roger B. Dannenberg and Robert L. Joseph describe their Piano Tutor (Blattner & Dannenberg, 1992, pp. 66-68). "How guides can support the user" (Blattner & Dannenberg, 1992, pp. 62-64) and "Separation of Content and Media" (Blattner & Dannenberg, 1992, p. 68) were used in the development phase of the TQL Trainer along with "The interaction with the User" (Blattner & Dannenberg, 1992, pp. 81-83).

(4) Human Factors in Engineering and Design. [Sanders, 1993] provided valuable information regarding useability and human interaction.

F. THESIS ORGANIZATION.

The remainder of the thesis is organized as follows:

- Chapter II, "Background", provides a general background on TQL, the Navy's training goals, and the unique aspects of implementing TQL within the DoN.
- Chapter III, "Design and Development", describes the step-by-step process used in developing the TQL prototype, design considerations for interactive, multimedia, instructional systems and a description of the final system developed.
- Chapter IV, "Conclusions & Recommendations", addresses suggested improvements and future expansion of the prototype as well as the answers to the initial research questions.
- Appendix, "Storyboards", includes representations of all of the screens in the TQL Trainer, identifying unique attributes (i.e. audio/video clips, automation, hypertext links, etc.) of each screen and associated links between pages of lesson material.

II. BACKGROUND

A. GENERAL INFORMATION.

A successful prototype cannot be developed to computerize TQL training for the Department of the Navy unless the developer thoroughly understands the TQL philosophy, as well as the traditional and non-traditional training methods available and utilized by the Navy. Realizing that no one method can be used for all training subjects, and that it is often good to have several methods of teaching the same subject, computerized training of TQL appears a feasible option. Although new tools (such as multimedia authoring programs) can enhance the presentation of subject material, effectiveness of the prototype in meeting its objectives is directly related to the culture of the targeted students and their mental preparedness for the subject material. The importance of TQL, as set forth in DoN's goals and objectives, and appropriate training methods for teaching TQL must be married in order to achieve the TQL transformation within DON.

B. THE IMPORTANCE OF TOTAL QUALITY LEADERSHIP.

The Department of the Navy has had to contend with rising costs, pressure to reduce defense expenditures, and reduced manning levels. It needs to become more efficient in its processes to maintain operational readiness. It needs to open lines of communication across functions in the Navy and Marine Corps by working together. It needs to achieve higher levels of internal integration of the logistics, maintenance, and acquisition functions as they relate to serving the operational forces. Support functions need to develop a customer orientation based on the new principles of quality. In the continuing downsizing trend, it is imperative that the DoN adopt a total quality approach so that it can better use the talents of all the people to create a "lean, powerful maritime force for this country's future." (UNSECNAV Howard, Proceedings, 1992).

TQL is a conceptual philosophy. "Conception" according to Webster's is "the originating of something in the mind; the capacity, function, or process of forming or understanding ideas or abstractions or their symbols; a complex product of abstract or reflective thinking." An abstraction is "something difficult to understand". This is one reason that total quality in all its various aspects is found unacceptable by those who prefer concrete, empirical subjects.

The Fundamentals of TQL course, developed by the Navy in 1992, includes the basic concepts and principles of TQL and therefore contains

important information for new students to learn. It is for this reason that the Fundamentals of TQL material was chosen for the prototype.

The scope of this thesis and the resulting prototype includes only the first lesson (Introduction) due to time constraints. However, since the most important concepts and ideas are included in this introductory information, the prototype can better demonstrate the depth and versatility of using such a tool, benefitting students of varying degrees of interest and prior TQL knowledge base. The following introductory concepts are included in the prototype:

- Background of TQL, specifically its origin from Dr. W. Edwards Deming's quality management philosophy (with optional information to increase the student's depth of knowledge), and its purpose and objectives within the Department of the Navy.
- The quality focus of TQL in which the customer defines quality, and that quality depends on preventing defects through ensuring quality is designed into the product or service and continual improvement of the processes that create the product or service. This is in contrast to the traditional final product inspection-for-defects method of producing quality.
- Change is needed to accomplish the cultural transformation to TQL, but change must be based on fact from supporting statistics, rather than change for change's sake.
- The relationship between basic concepts such as customer, supplier, process, and quality are important within Dr. Deming's methodology of continuous improvement.

C. THE UNIQUENESS OF TQL TRAINING REQUIREMENTS WITHIN DEPARTMENT OF THE NAVY.

Top leadership in the Navy and Marine Corps sees the value of TQL in two ways: 1) providing a better means of communication across the organization, and 2) emphasizing the importance of leadership. (Fundamentals of TQL, 1992, p. 61)

The Navy has always focused on good leadership. Additionally, the very rank and file order of the military requires empirical evidence to justify all decisions. For this reason, there is a myriad of directives and instructions, fitness reports and evaluations, along with training requirements to ensure that all information is specified as much as possible and performance is "standardized".

In order to achieve the TQL transformation, and in accordance with Dr. Deming's 14 Points (specifically point #2, "Learn the new philosophy, top management and everybody"), the Navy set in motion a plan to educate a critical mass of 150,000 sailors by 1996. This was accomplished through conducting the "Senior Leadership Seminar" for top Navy leaders, and creating a "Train the Trainer" program for educating the remainder of the critical mass. Training sites at Coronado and Little Creek brought sailors and leaders from all over the world into their classrooms to learn the TQL principles with the understanding that the leaders would return to their positions ready to implement the TQL philosophy, and trainers would continue the "critical mass" training at their various commands.

With manpower and budget decreasing, it is important to utilize all resources to their maximum capability. So even though most, if not all, commands now have TQL-trained instructors on board to fulfill the Navy's requirements, for many their TQL training responsibilities are still considered part-time.

Implementing TQL within any organization takes time and people who support and believe in the principles of total quality. Even senior leaders who have been educated in TQL and understand the time it takes to build total quality into an organization find it difficult to make time for training personnel, developing plans, assisting in QMBs, etc. in addition to their ongoing Navy mission responsibilities. TQL-trained instructors within the command also find it very difficult to promote the new philosophy while normal traditional functions require crisis responses in the traditional ways.

It is for these reasons that it is important to find alternative methods of training the fundamentals of TQL. Since it is extremely expensive to continuously train command trainers at only two locations (Coronado & Little Creek), and downsizing leaves little time for training on location, a computerized training system may offer many benefits. Additionally, the conceptual nature of TQL precludes the use of correspondence training. Because of its increased flexibility and just-in-time training capability, the TQL Trainer may help offset the effects of personnel downsizing and lack of time available for classroom training by permitting individual self-paced training.

D. SUMMARY.

To date, the focus of the Navy's TQL training program has been classroom instruction. The reality of life in the Navy, particularly the fleet, makes it imperative that this education and training process be conducted in a more flexible and efficient format that maintains the same,

or better, level of effectiveness than the current TQL-training system.

To be effective, system development must include: a thorough planning process (including research of material), best methods of presentation, and a means of measuring its effectiveness; all standards currently required for any training program. And, to be considered cost-effective, a computerized version must do more than merely copy classroom training. It needs to break new ground by creating an interactive, multimedia, learning environment. Only by achieving interesting, effective, time-saving training will the TQL Trainer provide meaningful assistance in meeting the Navy's TQL transformation goals.

III. DESIGN & DEVELOPMENT

A. METHODOLOGY USED IN DESIGN AND DEVELOPMENT.

The 10 stages of design & development methodology (Alessi, 1991, pp. 245-276) provided the basic guidelines used during the development of this system:

1. Determine needs and goals.

Determine the goals of each of the lessons presented. This includes what the student should know or be able to do after completing the lesson. Determine the entry knowledge of the students in order to assess the characteristics and instructional needs of your intended students.

Because the training manual is very specific as to learning objectives, this prototype must follow those same guidelines to permit compatibility between classroom and computerized instruction. The objectives for Lesson 1 are included in the Appendix (Figure 2, p. 41) along with the questions and review options (Figures 99-115, pp. 138-154) available to the student to ensure knowledge of the subject is achieved. Entry knowledge is minimal, since Lesson 1 contains TQL introductory information only.

2. Collect resources.

Resource materials for the instructional design include texts on instructional design, storyboarding sheets, graphics arts materials, a word processor, and persons who have experience in instructional design.

Other than the student guide which forms the primary resource for developing this course, the resources necessary were discussed previously in Chapter I of this thesis.

3. Learn the content.

This includes interviewing the expert, reading texts and other instructional materials. You cannot develop effective instruction which challenges the student in creative ways unless you become thoroughly familiar with the content.

A relatively thorough background in TQL had been established prior to attending Naval Postgraduate School. However, course #MN3805, "TQL & the Military" was also taken as part of the thesis preparation studies.

The course included much of the same information which was to be included in the prototype and provided many references and additional readings which were incorporated into the prototype as optional for the student's continued interest.

Although it was relatively easy to identify the resources needed, identifying the specific content was more difficult. The trick was to identify which objectives, if any, within each lesson that would be harder than others to design, and which multimedia tool to use for the greatest effect. Keeping in mind the expected low level of knowledge of the new personnel using the prototype, possible preconceived attitudes regarding the material to be learned, time and system limits, a hierarchy of information to be presented to the student which would be stimulating and worthwhile was developed. This same hierarchy is represented within the TQL Trainer as the "Map" function, which permits the student to see which subjects he/she has already reviewed as well as the ability to go directly to any other module (see Figure 129, p. 168)

Knowing the content of the material to be taught requires the developer to be able to understand the material at a level which can be expressed in many different ways to many different people. Additionally, the developer needs to know the student's intellectual skills and attitudes in order to be able to choose the best presentation method for the material which will lead to the greatest benefit.

Going back to the objectives of each lesson, the developer needs to reword these from the perspective of the student. In other words, the prototype will be successful if...the student is able to (specific lesson objective...i.e. understand the difficulty in defining "quality"). Only by doing this can the developer hope to choose the correct material to ensure the objective is met. Following the design methodology (Chapter III), the initial strategy was to step through the process rather quickly since the content was known and the material and tools were readily available. The design process was relatively straight-forward and easy to understand and follow. However, identifying and condensing the material required for the objectives to be met proved the most challenging.

4. Generate ideas.

Brainstorm to generate creative ideas. Have others help in this process and come up with a list of ideas without judgement of their quality or feasibility until a later time. This method facilitates creativity and quickly produces a list that will include some interesting and good ideas. Once the content ("what" to present to the student) is well understood from the perspective of the student, the problem of how to present is tackled.

It became apparent after the initial storyboards were completed and the primary information content was decided - that a more interesting approach to getting the information into the student's long-term memory was needed. Since TQL is so conceptual, with many interlocking puzzle pieces which need individual understanding in order to understand the whole, it was troublesome trying to invent a better way to present the material than the student guide provided. The use of multimedia to incorporate graphics, automation, and audio/video clips was used solely for the purpose of maintaining interest in the material being presented.

Since the outcome desired was for the student to understand the concept of TQL (declarative knowledge), the sequence of instruction is relatively unimportant. Although the thesis primarily deals with lesson 1 (the Introduction), the prototype was designed with the complete 7 lessons in mind, not merely the limited (Lesson 1) product which time restrictions dictated for completion of this thesis. In fact, some material (i.e. statistical process control (SPC) storyboards, (see Figure 5, p. 44) was included in the TQL Trainer to show the "linking" ability with Lesson 6 material.

It is important to note that, for lesson 1, the material is not reiterative, but rather basic information to set the recognition stage for the student. All important ideas/terms will be briefly discussed with reinforcement occurring in later lessons.

5. Design instruction.

From the ideas resulting from brainstorming, you eliminate the worst ideas and order, detail, and refine the remaining ideas that are good. Perform concept and task analysis on the content, revise initial ideas, reassess goals, collect additional resources needed, learn more about content, generate more ideas, etc. Keep in mind that this process is reiterative until all parties are agreed that the quality is sufficient to begin flowcharting the modules.

Since the information requirements were already established (DoN Fundamentals of TQL manual), the process of designing the prototype became the most intense portion of the project. The information contained in the manual is rather austere and meant to be presented in conjunction with instructor lectures, video tapes, etc. Even though the course material contains all important points and facts which are required by Navy policy, and thus provides the basis for beginning the design phase, it is too voluminous to just be transferred into computerized form. Condensation was needed along with interactive "chunks" of learning material and multimedia "interesting" attention getters.

6. Flowchart the lesson.

This is important to do because computer-based instruction should be interactive, and this process should be depicted as a visual representation of decisions and events.

This step was omitted for the purpose of this thesis simply because only Lesson 1 was developed. Since Lesson 1 is introductory information, interaction with the student is limited to a specific set of terms to be defined and only minimally links to other files or sources of information as needed to fully demonstrate the potential of such a prototype. Therefore, the flowchart, if developed, would look very much like a simple heirarchical diagram.

7. Storyboard displays on paper.

This is the process of preparing textual and pictorial displays so they fit within the display limitations of a computer. It depicts the lesson's content and presentations, so the actual instructional messages to the students as well as questions, feedback, directions, prompts, pictures, and animations are displayed.

Toolbook was utilized to prepare the storyboards as well as the development tool for the prototype. This resulted in greater efficiency due to the ease with which Toolbook permits changes and rewrites. Various screens were created quickly as separate pages which could be linked in any desired order, or discarded. The print option in Toolbook allowed printing as bitmaps which were clear representations of the actual screens. These served perfectly as storyboards, providing additional space on each printout for screen numbers and amplifying information. Storyboards are included as Appendix A.

There were two primary revisions to the original storyboards, the first revision being a major redevelopment and restructuring of the module. The second revision was only minor in nature, requiring some additional depth of material and smoother transitional links between topics.

8. Program the lesson.

This includes writing the code in a standard language as well as developing a program utilizing one of the authoring tools available.

Toolbook was used as the authoring tool due to its flexibility, ease of construction, and accessibility. During the information requirements gathering phase, Toolbook software was reviewed, and a large portion of the learning curve was conquered.

Authoring systems are productivity tools that provide developers with predesigned modules used to piece together the components of multimedia packages. Such systems may not completely avoid the necessity for some programming, but they make the job a lot less complex - and more fun - than developing an application from scratch...An authoring system must be appropriate to the skills of its users. In this context, ease of use and availability of training tools become important criteria for any system that will be handled by individuals who possess little or not programming experience. (Livingston, 1994)

In Toolbook, screens are created as separate pages of a book which can be easily renumbered, relinked to other pages (as with hypertext links), or left unlinked for later expansion of the prototype.

The multimedia aspects of Toolbook provided the greatest challenge. The limited prototype (Lesson 1 only) was designed to incorporate at least one sample of all multimedia tools: video, automation, and sound.

9. Produce supporting materials.

This includes student manuals, instructor manuals, technical manuals, and adjunct instruction.

This thesis with appendices will serve as the primary source of guidance for follow-on project work, whether it is a completed prototype (encompassing all 7 lessons) or revisions of this prototype for later re-evaluation. An instructor/student manual was not completed as part of this thesis.

10. Evaluate and revise.

The lessons as well as all supporting materials are evaluated by real students. This step includes pilot testing and validation.

This thesis and associated appendices provide the only supporting materials and will not include test and evaluation of the TQL Trainer.

B. GENERAL PRINCIPLES OF DESIGNING INSTRUCTIONAL, MULTIMEDIA, AND INTERACTIVE SYSTEMS.

This prototype is instructional in nature, with the additional benefits of multimedia events and user required interactivity to increase its effectiveness. These three facets required specific attention in the designing of the prototype, and are discussed below.

1. Principles for designing instructional systems.

Although the goal of multimedia systems is often to recreate natural settings (which is why many systems use clips or cartoon images of professors with chalkboards as backgrounds) this works only as well as it is reinforced by other modalities (multimodal). In other words, a video tape must bulletize (organize and display) important points if it is necessary for the student to remember them. By using one mode of information exchange to reinforce another, there is a greater ability for the student to retain the information presented. This is because "people communicate most effectively when they can use multiple communication channels and most often this is through pictures (visual) and speech (audio)" (Blattner & Dannenberg, 1992, p. 101). Communication barriers such as different dialogs, symbology, etc. are overcome when pictures, gestures and eye contact are added to speech. So effectively, a picture can be worth a thousand words.

Computerized training systems can prove effective because of their ability to organize the material to be trained in such a way as to permit the student the ability to see pictures, graphs, diagrams along with the written words. Multimedia systems go further by incorporating the ability to automate the graphs and diagrams, hear the words, and see a video clip as well as the standard pictures and written words. The primary concern of an instructional system designer is "how to combine all the ways of presenting material in such a way as to create an interesting and effective learning environment for the student." (Blattner & Dannenberg, 1992, p.81). Additionally, in order to be efficient, a balance must be struck between providing the student sufficient time to acquire the requisite knowledge and skills, while minimizing the total time spent on training.

2. Principles for incorporating multimedia events.

Multimedia is the fusion of text, still images, 3D animation, graphics, audio, and full-motion video in a PC environment. (ARINC Research Corporation, 1994)

Unlike most PC software which requires the content be provided by the user, multimedia applications create and produce content, similar to a movie or a book.

The best design is one that pleases all senses. People differ, however, in the way they like to receive or give information. Without giving too many possibilities to choose from, users should be able to handle information in different ways on different channels. (Blattenberg & Dannenberg, 1992, p. 81)

Incorporating multimedia into a training system is more difficult than merely importing a video and or audio clip, or automating a procedure. Rather, the effectiveness of the multimedia can be determined by the user interfaces and their ability to cope with all the various forms of information displayed. Hypermedia permits the student to jump to definitions if an unfamiliar term should appear, or to review previous material at the touch of a button if the material is forgotten. Creating a system which permits this ability is extremely difficult because it requires good material organization planning and appropriate links between key subjects or associated objects. In the best of planning, the student should not run across unfamiliar terms nor return to previously taught material. However, although a system can be designed to handle these problems, it becomes a very structured format in which the student loses the ability to go with his individual ideas at the moment.

The advantages gained through the use of multimedia are many and include increased technical comprehension and reduced training time; standardized delivery of information; training on demand, capturing and sharing corporate knowledge; reduction of hard copy documentation; low cost distribution of media; improved learning attention span because of the intuitive use of audio, video, graphics, and 3D animations; and a broad range of flexible design options. (ARINC Research Corporation, 1994)

Since multimedia does not make sense for small non-repetitive training requirements, even greater savings are realized when applied on a large scale, long term, repetitive training program, such as Navy's TQL training:

- Reduced travel & per diem requirements
- Reduced loss of productive labor time
- Reduced overall student and instructor training time

- Reduced time to productive mode due to training on demand...rather than waiting for scheduled classes, the student learns faster and is able to apply that knowledge faster.
- Refresher training available as often as needed
- Bringing new procedures, knowledge, or sharing existing knowledge among all employees is easier, regardless of distance between the student and the teacher.

Multimedia applications provide the potential for stretching budgets further, improving information access and retention, reducing the training time thereby increasing productivity, by turning trained individuals back into the workplace faster. (ARINC Research Corporation, 1994)

3. General principles for designing interactive systems.

Interactive instruction offers a solution for minimizing training time without sacrificing desired training outcomes. Commonly used names for interactive instruction include: computer-based instruction (CBI), computer-based training (CBT), and interactive video (CD-I, DVI and IVD). (Dennis, 1994)

An interactive system offers the student a wide variety of options which aid in the learning process. Interactivity must be at a level to make the content interesting without the complexities of a random database access program. In other words, a well defined structure must exist for the student to be able to easily indentify what material he has covered, what material he may have missed, as well as the option to review and/or call up various subjects in varying depths of knowledge. Without such a structure, the student is merely accessing a database of information with minimal structure which requires the student to keep account of his own progression through the necessary material. This "keeping account" increases the cognitive load on the student. To reduce this, an interactive system must provide the student with navigational and content knowledge guidelines at a minimum. This allows the student to ask "where am I and where should I go next?"...and the systems responds by providing the answers for the student. This guidance serves as a safety net for the student, permitting greater confidence and independence to explore and follow their ideas and interests, while always knowing they can "recover" and get back on track when desired.

According to (Dennis, 1994), interactive systems can save time through:

- On-demand availability. (No need to wait for scheduled training)
- Students can access only the training that is needed. (Interactive training can be organized into modules that address specific job skills or tasks that can be easily accessed individually to meet specific training needs)
- Self-paced. (The student's individual pace is not tied to the pace of a group of students)
- Exemption testing. (Students can often "test out" of certain modules, saving time by going on to areas in which they require training)
- Smart teaching strategies. (The computer can monitor the performance of the student and adjust the instruction accordingly, providing more practice and examples as needed to ensure the individual student understands the material)
- Interactivity/Feedback. (The training system interacts with the student frequently since learning is quicker when understanding is tested frequently, and feedback on mistakes is given immediately)
- Multimedia. (Multimedia is used with interactive instruction to present the material in a format that is easier, and thus, faster to assimilate)
- Simulation of the job. (Learning that would normally take place over months or years in the real world can be compressed into a few hours with interactive training)
- Automated record keeping and reporting. (A record of training activity can automatically be posted to the training database upon completion of a module)
- Teach only what is needed to get the job done. (The instructor can tailor the training to teach only what is needed)

C. DESCRIPTION OF THE SYSTEM

The TQL Trainer is an interactive multimedia training (instructional) system to teach the basic principles of Total Quality Leadership. The system currently teaches Lesson 1, equating to 62 pages,

of the "DON Fundamentals of TQL" manual. It is intended for people who are being introduced to TQL principles as well as those requiring review of important ideas.

A major challenge in the design of the TQL Trainer was to communicate effectively, since it delivers a large amount of information with complex ideas to an audience who are, for the most part, unfamiliar with management training methodologies.

The TQL Trainer interacts with a single student and consists of a personal computer (386SX or better) and ideally loaded with a multimedia package to permit the student to fully experience the multimedia aspects of the system (although multimedia package is not required). The welcome screen (see Figure 1, p. 40) provides the student with the basic instructions for use of the TQL Trainer and permits selection of 1 of 7 lessons, a "How to use this book" section (which describe use of the navigational buttons), or course review and optional test.

In a typical interaction with the TQL Trainer, the material is presented to the student using video/audio clips and all material can be stepped through very methodically (meaning that required information is presented in a "next page" format) or to varying depths (through hotword links throughout the lesson). When lost, the student is provided assistance through a "Map" module, which not only show the student where he is at the moment, but also the information that has been missed (see Figure 129, p.168). The map is presented in a hierarchical diagram, which permits the student to select any topic and go to it directly, and is provided a highlighted "you were here last" block, guides the student up the chain within the same topic, or to another separate topic as the student desires. He/she may even choose to review material previously transgressed. Additionally, help is provided through the use of a readily available "table of contents" button, backward stepping button "backtrack", "glossary" of terms button, and "exit" program button (see Figures 126-129, pp. 165-168). Through a combination of these, the student can easily ensure that all information is learned in the order of the student's choosing.

At the end of the lesson, the student is given the opportunity to review the important points and an optional review/quiz before exiting the program or going on to a later lesson when implemented (see Figure 109, p.148). Because the original manual used text (with video tapes/slides), the course content had already been tested for its ability to communicate effectively with the students. However, in order to condense what was otherwise an 8 hour presentation (Lesson 1 only) into a 1 hour training module, the content had to be further fine tuned for directness and

clarity, with minimal use of video/audio clips. The notion of content and media were separate in the original classroom training in which the video clips/overhead slides were instructional aids, not required for basic information content but only used in an explanatory manner. Incorporating this aspect into the TQL Trainer, the audio clips are shown by separate icon than video clips and both contain only **optional** material. Making these media "optional" builds in flexibility in that the TQL Trainer can be used by more students whose systems do not accommodate the hardware/software/multimedia configuration required. This media-independence is especially important in the Navy-Marine Corp environment which varies from shipboard to overseas utilization. Because the software used to build the TQL Trainer uses buttons to open a link between the TQL Trainer and the media applications before media execution, an error message will inform users if their system is not configured to handle the media associated with the particular button pressed. Since these links are with the buttons and not the TQL Trainer itself, the TQL Trainer can still be used even without meeting the special media requirements. The "optional" feature has been carried over into the TQL Trainer with regard to required versus optional material content through the use of dark colored "optional material" buttons light colored "required material" buttons).

The TQL Trainer handles interactivity through the grouping of "exit", "contents", "backtrack", "glossary", and "map" navigational buttons, which appear in the same buttons in the same place on every page, as well as various user input points such as "describing quality in the your own words"...or "enter a product, customer (internal & external), and suppliers of a product or service familiar to you". There is also a review and quiz which reiterate important points, as well as provide immediate feedback to the student.

The multimedia aspects of the TQL Trainer include a 10 second video clip of Dr. Deming, automation (moving vehicles), and an audio clip pertaining to "Why TQL?". The intense storage requirements of these features dictate only minimal usage of such enhancements if Navy-wide dissemination of the program is to be considered.

The TQL Trainer contends with instructional requirements through the use of 1 (or more layered) boxes of information per page, questions to encourage individual reflection, graphics for visual interest, and bold, oversize lettering of important ideas/concepts. Some referenced (optional) documents have been scanned and imported as readable material as well. Of course, as previously discussed, the use of interactivity and

multimedia video/audio clips also help build upon the important instructional material by bringing into play the multimodal aspects of learning.

After selecting the "Lesson 1" tab from the TQL Trainer's welcome screen, the student is provided with a list of Lesson 1 Objectives (see Figure 2, p. 41). Continuing on, the student is presented with multimodal learning in that the screen shows textual information with the "optional" audio button as well. Entering the next page (continue button), the student is presented with background information (see Figure 4, p. 43), including Dr. W. Edwards Deming's involvement in the Total Quality methodology. At this point the student is presented with both required information (Deming's Approach to Quality Management) and optional information (Statistical Control Techniques and Dr. W. Edwards Deming). To ensure the student is alerted to this difference, he is presented with an announcement: "This is optional information only at this time, do you wish to continue?" (yes/no) when optional buttons are pressed. This announcement will only be displayed for the first few "optional" buttons shown to reduce overall keystrokes. After this, it is assumed that the student is aware of the difference between the "optional" and "required" information. As an additional feature for the student, the buttons change to white after selection. In this way, a student who is returned to a screen which contains several buttons can easily identify which material he/she has already reviewed.

When the student chooses "optional" information such as Statistical Control Techniques (see Figure 5, p. 44), he is often "linked" to other lesson material. These "links" provide the greatest difficulty for the designer/developer. If the authoring system utilized has very powerful navigational tools which make recovery (return to the original "optional" button) easy for the student to understand, then it is good to let the student explore without control. As mentioned in earlier, it is difficult when a student wanders to ensure he/she will be familiar with terms and definitions regarding material which has not yet been "learned" in the normal lesson progression. The TQL Trainer has a powerful "backtrack" button, so the student can backstep to the original screen. However, with conceptual material such as Total Quality Leadership, it is extremely important to keep the training somewhat structured in order to guide the student toward the *idea* of TQL, not just definitional terminology or procedural mastery. For this reason, pages have been developed to encompass a brief overview of a particular subject so that, when linked from an earlier lesson, only that page will be accessible by the student at that time. He/she will be able to briefly review the subject during

this initial visit, and will recognize some or all of it when they come back to it in greater detail in later lessons. The Statistical Process Control "link" has been expanded for the TQL Trainer prototype to demonstrate the use of graphics and text boxes and to give the student a brief overview of the various statistical control techniques which are used to "measure" variation in quality. The Fishbone Demo (see Figures 9-14, pp. 48-53) uses a series of graphics and text boxes to step the student through the building of a fishbone chart.

"Deming's 14 Points for Management" (see Figures 24-37, pp. 63-76) is a good example of a "linked" overview page. A 5th level box on the "Map" for the TQL Trainer, it will actually be a 3rd level item on a different lesson map in the final TQL Trainer. This single "page" has all 14 points described briefly and displayed one at a time. The student steps through them at his own pace and, after the last point is shown, will either return to previous lesson material, or continue to lesson 7 material.

Figure 39, p. 78 depicts the use of graphics for automation, and Toolbook permits automatic scripting to easily accomplish automation. Since a graphic is just an object to Toolbook, the developer can just "move" the graphic while recording a script. Make this script part of the page features, and the graphic will automatically "move" when a student enters that page. Automation breaks the monotony of text boxed material and is an excellent tool to stimulate the student with the power of pictures. (In this page, the tank moves into the page from the right, and a car moves across the page, right to left, from the rectangle).

Figures 40-44, pp. 79-83 are overlays on a single page which requires interaction by the student. The various "wine" characteristic buttons are displayed one at a time as the student presses each.

The student is then required to enter up to three words/phrases to describe what quality means to them (see Figure 45, p. 84). If the student types in one of the listed characters (shown next page in the TQL Trainer or Figure 46, p. 85), a text box containing their entry will appear to positively reinforce their train of thought. After the student enters the last phrase, the next page displays the student's entries with color matches to the list of typical characteristics described. If the student has not chosen a match with the list, the box will still contain their entries, but with no color matches. It is assumed that the student will compare the list with his/her selections.

Figures 49-56, pp. 88-95 requires further interaction by the student. He/she is asked a question, given the answer, and then asked to personalize a response. Specifically, he/she is asked "What is a

Customer?" Continuing on, he/she is given the answer; then asked to "Think about how you would define supplier". Finally, he/she must enter a product/service which he/she provides, a name of a supplier, and internal as well as external customers of the product/service they provide. All this information is displayed together to provide the student with the concept of customer/supplier relationships.

A text block stating "Congratulations! You have completed Lesson 1!" is displayed over the review page (see Figures 99-108, pp. 138-147) for a brief 2 seconds. The review blocks reiterate the important facts to be understood from Lesson 1. Selection of any one of the eight blocks (which correspond to the original 8 lesson objectives) displays a textblock of information relating to that subject. The review page also allows the student to go on to the optional test. The optional test (see Figures 111-115, pp. 150-154) permits the student to: cancel (leaving the wrong answer entered), retry, or review the subject material whenever the question is missed. A correct answer will display a textblock "That's right!". The questions are easy if the student has seriously read the required material. Evenso, if the student selects the review option when wrong answers have been entered, he/she can immediately discover the correct answer and re-enter it correctly. Upon completion of the test, the student presses the "test completed" button, and is rewarded with "Congratulations! Your answers were all correct!" or "The following questions were missed:". For all questions missed, there is a brief statement which reflects what correct answer should've been entered. Since Lesson 1 material is introductory in nature, the test is only to reiterate important facts which will be built upon later. It is important that the student not feel the pressure of specific scores, nor be forced to redo the lesson. Lesson 1 is simple in design and content, and decidedly so, since it is familiarizing the student with the material content for the first time, as well as the TQL Trainer and its use.

1. Human Factor Considerations.

A Human Factors course (OS3404) was helpful at the beginning of the development phase in gaining a better understanding of the use of available tools such as color, buttons, performance, program feedback, and other human considerations for such a computerized prototype. Three primary developmental concerns were emphasized:

a. Time Limitation.

Time is personal, and computerized training does not have the time restriction imposed on classroom instruction. This can be good as well as bad. The student has more time to leisurely browse through the material, learning at his/her own pace. However, the student who finds the material less than challenging may be bored and less attentive if the timing between topics is extended or it takes too long to complete the module. For this reason, it was felt that 1 hour of computerized instruction per lesson would be a good starting point.

b. Comprehension.

Another factor to capturing the student's attention is to ensure the material is meaningful and understandable. This is very difficult to estimate and, especially with multimedia training packages, very difficult to evaluate. Since the Fundamentals of TQL course has been taught for several years, however, some "Lessons learned" were incorporated into the TQL Trainer. Such items such as:

- Use examples with which the student can identify.
- Keep required reading to a minimum.
- Incorporate many modes of information.
- Keep interactivity level high.
- Keep training time per module at a minimum.

Other considerations mentioned in (Sanders, 1993) focused on the comprehensibility of the system itself:

- Locate buttons where they can easily be found by students, with a standard layout from screen to screen for consistency. It is important that the students study the material presented rather than trying to decipher what the buttons mean. Allow the student maneuverability between screens for review of information as necessary as well as immediate program exit.

- Text should be limited to no more than 25% of the total screen space allowed. This requires breaking the information into easily digestible bites of information. Care must be taken, however, not to construct a seemingly endless stream of information that loses its place in the heirarchical

structure, since the student uses the structure to assist in learning the material.

c. Useability.

Useability ties the time limit and comprehension considerations together with product desirability from the user's perspective. Did the product do what it was supposed to do?...Did the student perform as expected?...Did the system respond as expected? Useability of a product gives an indication of future utilization of a product in that even the best, most efficient system designed has no future utilization if the user does not like it!

There are ten heuristics to ensuring useability of a system (Nielsen, 1994):

- Visibility of system status: The system should always keep users informed about what is going on through appropriate feedback within reasonable time.
- Match between system and the real world: The system should speak the users' language, with words/phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
- User control and freedom: Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue.
- Consistency and standards: Users should not have to wonder whether different words, situations, or actions mean the same thing.
- Error prevention: Even better than good error messages is careful design which prevents a problem from occurring in the first place.
- Recognition rather than recall: Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
- Flexibility and efficiency of use: Accelerators - unseen by the novice user - may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users.
- Aesthetic and minimalist design: Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

- Help users recognize, diagnose, and recover from errors: Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
- Help and documentation: Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not too large.

2. H/W, S/W capabilities/limitations.

Trying to implement multimodel objects for training is easier said than done. High speed random access storage for large amounts of video/audio is not currently cost effective, but data compression techniques will soon limit this point of contention. For the time being, the material content was designed into the system such that additional video/audio clips could easily be added at a later date as desired.

Hardware consists of a 486DX with audio and video/graphic cards. The software was also loaded on a 386SX without sound/audio boards installed for backup development purposes. Updated versions of the developing program could be loaded into either machine with only the difference in screen resolutions causing minor frustrations (super VGA suggested). Soon, systems with parallel processors, multi-threaded servers and synchronous windowing extensions will help the designer to activate and deactivate multimedia events on schedule. Without these, the designer must spend a lot of time making sure desired events happen when they are supposed to and limit their elaborative designing in order to keep the student's attention onto the material at hand. Systems which are not designed for quick access to data (items such as video/audio clips as well as text screens) can make the student wait for response. This distraction most of all should be avoided at all cost.

Software used in developing the TQL Trainer is TOOLBOOK, Software Construction Set for Windows by Asymetrix Corporation in Bellevue, Washington. Toolbook can be used to develop a variety of applications (application is a computer program that performs specific tasks). A Toolbook application consists of one or more books that are designed for a particular purpose, such as training, information management, or entertainment. The books can be just a collection of information, an interface for another application, or an application in and of itself. The books can be revised at any time by changing the information within, the way the book is organized, or the tasks it performs. Like a printed book, a book in ToolBook is divided into pages, which represent

application screens. The pages of a book are stored together as a DOS file, and separate books may be interlinked for larger applications or module reuse. ToolBook is object-oriented. The buttons, fields, and graphics created within the pages are all objects that have properties which can be changed or altered for each page. Any object can also have a script that defines how the object behaves. In this way, objects can "move" across a page (automation), send data to other objects, or perform calculations.

The Toolbook Authoring System permitted the training modules to be created easily and quickly. There was a relatively short learning curve required, with many multimedia options available. Because Toolbook is built in "pages", it approximates the building of a book, and the windows-driven commands made it extremely easy to understand. Terms such as "new page", "previous page" etc. make it flexible enough for later expansion/modification, or similiar development projects (i.e. separate books which link to and expand knowledge of a subject in the original book).

3. Domain capabilities/limitations.

As was mentioned earlier, material content was limited to DoN's Fundamentals of TQL course. The manual, encompassing a total of seven lessons with numerous recommended video tapes and class exercises, is usually taught in typical Navy 40 hour classroom style. Allowing for coffee breaks and long lunches, this equates to approximately 3 hours per lesson. Since this prototype concentrated on Lesson 1 material only, it was necessary to condense 62 pages of written material into 1 hour of computer-driven instructional material. Like the Readers Digest Condensed Books, important points had to be identified, explanatory material added as necessary for understanding, and wordy definitions reduced to more direct concise statements.

It is hoped that the interactive, multimedia enhancements as well as the text blocks designed into the TQL Trainer focus on the most important ideas of the Fundamentals of TQL course (Lesson 1) allowing all objectives to be met.

4. Modularity.

No computerized instructional prototype can be developed merely by following a textual manual, and the organization of course content was only one concern in building the TQL Trainer. Alessi's 10 steps provided

only guidelines to be followed. General principles of interactive training as well as streamlining the multimedia aspects into an effective learning tool also required attention in the design.

Although ToolBook is an object-oriented program, careful planning was needed to ensure that all "chunks" of information (separate or a combination of objects) created could be independently utilized as often as necessary throughout the training process. The complexities of hotwords, for instance, represent only one problem in designing an effective interactive training system. For example, how does one create a module which can be accessed from anywhere in the program, has educational benefit at 4 or 5 places within the program, with the additional requirement that the module must contain only pertinent information to the user no matter from where the user came, always returning him to his previous location with a smooth transition of instructional effect? The course material, student characteristics, system environment, and other such factors must be considered to ensure an effective instructional aid.

Modularity provides only a weak structure for the organization of information. Chunks of information is more true to reality as the heirarchical diagram (Figure 129 p. 168) shows. Unlike a typical procedure-oriented programming language which consists of main modules, procedural modules, etc., the object-oriented language loosely couples objects which are very independent and often too easily called. The designer must contend with these multitude of objects, keeping in mind all the principles and guidelines, the audience and the course requirements, and create an organization of objects which achieves the desired objectives. The balance between "no organization" as in a random access database, and "total organization" as in a procedure based language must be met. As a result of permitting the student freedom to explore, navigational aids within the program are required. As a result of meeting course requirements, the student is given guidelines (i.e. yellow background blocks of text only) for important points to remember. This excess baggage on behalf of freedom to explore confuses the normal step by step instructional model, and requires more memory, more screens (i.e. glossary, map), and certain areas where the navigational aids are restricted for the sake of instructional comprehension. Overall, however, the student is able to learn at his own pace and in his own style.

IV. CONCLUSIONS & RECOMMENDATIONS

A. SUBJECTIVE EVALUATION.

The TQL Trainer has proven a very interesting experience. After the 3rd revision of material content and transitional links between subjects, the system came together comfortably. It is simple, as it should be, yet accomplishes the objectives, either through paging through the material with the "continue" buttons, or by reviewing the important facts at the end of the lesson, or by reviewing the material following incorrect answers to the optional quiz located at the end of each lesson. In this way, the TQL Trainer is reiterative as well as multimodal. The navigational buttons provide the student with the freedom to explore and the security in knowing he/she can always get back to the "important information." This instructional, multimedia, interactive training system has met both the Navy's, the student's, and the developer's objectives, and is now ready for a formal test and evaluation. I feel the TQL Trainer provides a good start for beginners learning the TQL methodology.

B. PROTOTYPE IMPROVEMENTS NEEDED.

Other than the obvious completion of the remaining six lessons, the TQL Trainer could be enhanced further by some of the new authoring programs becoming available. Better hardware and software can effect a smoother, more profession training system. These enhancements will not come without some cost...specifically, greater memory requirements, audio/video board requirements, more money up front and the possibility that less Navy users will have the hardware/software to support these more powerful requirements. A formal test and evaluation should show the cost benefit of utilizing the TQL Trainer "as is" versus improving it through different hardware/software. Simple improvements, however, could be made with better video clips of Dr. Deming, and better graphics. These simple improvements are highly recommended.

Additionally, the "Map" feature is an important navigational tool and needs to be fine-tuned. It would also be helpful if the map were displayed at the end of a lesson, prior to the review page, for two reasons. The student could be asked if all "required" information has been completed (in case some buttons were missed), and the student could also be given the option to "explore" and select at random some blocks of information if he has the time and/or inclination. This suggestion is also highly recommended.

Another feature which is highly recommended if expansion is considered is the ability for each student to save his place in the lesson structure. There is currently no allowance for this, but this feature could be easily incorporated into the program. The limited Lesson 1 material did not require this, but with close to 1,000 pages (complete program with 7 lessons), it would be extremely helpful to the student.

C. PROTOTYPE EXPANSION.

The TQL Trainer will require an extensive test & evaluation to see whether (or not) it has a cost benefit to disseminate "as is" , with recommended changes above, only minimal expansion, major expansion to include all 7 lessons and/or related subjects, or whether it would be better to utilize a different hardware/software package altogether.

Along with the expansion to include all seven lessons would come greater depth of material and related subject comparison to dispell any confusion for the student. Such items such as the differences between Total Quality Management (TQM) and TQL, other similar methodologies compared to Deming's, and, if networked, active Navy programs with which the students could readily and easily connect to get current policies and project feedback. This would also reinforce the feeling that the larger Navy goals are for everyone to get involved in and to work towards continuous improvement. With network access realizable by everyone very near in the future, TQL training of this kind would speed up the training substantially. Accessing a network could result in sharing of process flowcharts, corresponding with others who have the same concerns/problems, brainstorming, and a greater feeling of ease in sharing new ideas with others than the current "classroom" training allows.

The TQL Trainer will permit more efficient training of the "critical mass". More importantly, those who were classroom trained two years ago, and have gone back to commands who have not utilized the principles, have lost that knowledge. This training package will help get those persons back on track, speaking the TQL game, and ready to join in the TQL transformation taking place. Although it is true that there is strength in numbers, it is also true that not everyone can be in class at the same time and that people learn at different rates and in different ways. As mentioned earlier, frame of mind is very important as to the acceptance of a product like the TQL Trainer. The need for "critical mass" training has to be a factor in the cost benefit analysis along with whether there is a

strong support structure in place to coordinate and "market" the TQL Trainer and its use. Without the need or requirement for its use, the TQL Trainer will be a waste of time and money.

D. RECOMMENDATIONS & CONCLUSIONS.

Further test & evaluation on this prototype is highly recommended. Since Toolbook is an icon driven program, it is very easy to learn, so changes and/or expansions are very possible. This same program can be converted to a newer version of Toolbook to permit even greater enhancements, CD copies, etc. A copy of the program, along with installation, hardware/software instructions, will be retained by the thesis advisor for further consideration.

E. REVIEW OF RESEARCH QUESTIONS.

1. Primary Research:

a. *What factors are to be considered in the design and development of a computerized training system for the Department of the Navy to teach the Fundamentals of Total Quality Leadership (TQL)?*

A computerized Fundamentals of Total Quality Leadership training system must be designed with both the students' as well as the Navy's overall training objectives in mind. To meet the Navy's overall training objectives, the system must assist in the "critical mass" training required in order to accomplish the desired TQL transformation Navy-wide. With limited manpower and funding, a training system must be easily accessible by all commands and permit just-in-time training on an individual basis. To meet the students' needs, a training system must be interactive, permitting navigational control (repeat, exit, continue) at a minimum by the student. The system should be able to hold the interest of the student and provide the information in various forms to be easily understood by everyone. The TQL Trainer fulfills both the Navy's overall training requirements as well as the students' individual instructional requirements.

The information requirements for the prototype were determined to be limited to Lesson 1 objectives. Additionally, it was important to include a large number of the TQL terms and definitions in the Lesson 1 material so that the student received initial review of terms which could be later built upon in greater detail. The minimum information requirements were found to be the facts which would ensure the student could achieve the desired objectives. (Additional material was added to provide depth for individual study only). The following objectives of

Lesson 1 were met by the factual material (bulletized), and underlined subjects were specified as buttons:

W. E. Deming's contribution to quality management

- Deming introduced Statistical Control Techniques to Japan in 1950's after being part of the Japanese reconstruction team in 1945.
- Deming is credited with having had a major influence on Japan's economic recovery after WWII and is known as the "Father of Quality".
- Deming's Approach to Quality Management details his quality focused methodology and forms the basis for the Navy's TQL focus.

Dimensions of quality

- Quality is often characterized by it's dimensions; is not easy to define and is much harder to attain.
- A quality product or service is very much a factor of what the product or service is used for.

The customer defines quality

- A customer is a user of a product or service.
- There are both external (user outside unit or organization) customers and internal (user inside unit or organization) customers.
- If you provide a product or service, most likely you are the customer of someone else's product or service...that someone else is your supplier. A supplier is a person or group who provides input to a process.
- There are both external (person or group outside the unit or organization) suppliers and internal (person or group inside the unit or organization) suppliers.
- With the customer/supplier relationship in mind, the difficulty in defining quality is to translate future needs of the customer into measurable characteristics so that a product/service can be designed by the supplier and turned out to give satisfaction at a price that the customer will pay.
- Since the customer defines quality in a product/service, it is important to ensure that the process used to produce the product/service is designed with quality in mind.
- The customer's definition of quality depends on context, perception, needs & wants.

All work is composed of processes

- A process is a series of operations or steps that result in a product or service
- A process is a set of causes and conditions that work together to transform inputs into outcomes.
- To achieve a quality product/service, the process could include inspection for defects or it could try to prevent defects through continuous process improvement.

Quality is achieved through continuous process improvement

- Continuous process improvement can take many forms: enhancing value to the customer through new and improved products and services; reducing errors, defects, and waste; improving responsiveness and cycle time performance; improving productivity and effectiveness in the use of all resources.

Definition of Total Quality Leadership

- TQL is the application of quantitative methods and the knowledge of people to assess and improve: materials and services supplied to the organization; all significant processes within the organization; meeting the needs of the end-user, now and in the future.

Deming's Chain Reaction for Quality Improvement

- The chain reaction states that decreased costs and increased productivity are results of improved quality.

Importance of a Customer Feedback System

- Since TQL is based on the principle that the customer defines quality, the system in place to capture the customer's requirements should provide the decision maker with useful information to identify these requirements to ensure customer satisfaction. Therefore, a customer feedback system should: reflect what the customer wants; contain meaningful information; be active rather than passive; be ongoing.

2. Secondary Research:

- How to effect interesting, interactive computerized training?*
- What is the best way of incorporating multimedia features to effect interesting, interactive computerized training?*

Multimedia enhances computerized training and, if properly integrated, leads to more effective training. If only a computerized "book" is provided to the student, he/she will become bored or tired of reading screen after screen of information. The results of becoming bored with the medium is lack of concentration and lack of information retention. Multimedia, the use of audio/video, automation, text and

graphics within an application, serves to make the material more interesting and more effective due to its multimodal capabilities. By using an appropriate combination of audio and video clips, automation and graphics interdispersed with textual material, the student can experience something new, and therefore something memorable, with every important fact presented. Add to the experience interactive responses directed to the student or required of the student, and attention is maintained. The overall result is an interesting, effective instructional training system. The TQL Trainer has proven its ability to hold the student's interest and meet its training objectives as noted in the five surveys completed.

F. SUMMARY.

Based on the obvious need that exists for time saving, effective aids for Navy TQL instructors to accomplish the TQL transformation, the TQL Trainer represents a good model on which to conduct further test and evaluation and/or cost benefit analysis. It covers the important material, meets the content objectives of Lesson 1, has the ability to test the student's knowledge of the material, while presenting the information in an interactive, entertaining way through the use of multimedia, graphics, audio/video clips, automation, and immediate feedback from the student. The navigational features never leave the student stranded as he/she delves into as much depth as desired about the subject material, while always able to get back on track with the "map" function included. However, a test & evaluation is still required to ensure the TQL Trainer meets its effectiveness objectives.

The TQL Trainer meets the developer's objectives as well, utilizing an authoring construction set to condense and pull together a conceptual subject into a form which is easy to build, easy to use, easy to change, easy to expand, and which incorporates interactivity, instructional, and multimedia features into one very manageable component. It is hoped that the TQL Trainer can be utilized in the very near future, leading to a more efficient "critical mass training" of the 150,000 sailors to meet the Navy's TQL transformation goals.

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APPENDIX: STORYBOARDS

The attached storyboards represent all of the "pages" included in the Lesson 1 "Book". The Toolbook program, named "TQL Trainer" offers the student the ability to traverse Lesson 1 of "Fundamentals of Total Quality Leadership" in a step-by-step method by using continue keys and selecting all pale yellow buttons on each page, or by giving the student the option to go wherever he/she wishes, to whatever depth desired.

The storyboards are attached in order of the heirarchical diagram (see Figure 129, p. 168). This heirarchical diagram is the same diagram uses in the "map" option of the prototype, which helps the user get back on track as well as to see where they've been. The blocks turn green when traversed, and red representing the immediately preceding page (the page the student came to be before choosing "Map").

Each storyboard lists where the buttons on that particular page lead to, the page number, and the page after ("continue to"). Some interesting features about various pages are also noted on the storyboards.

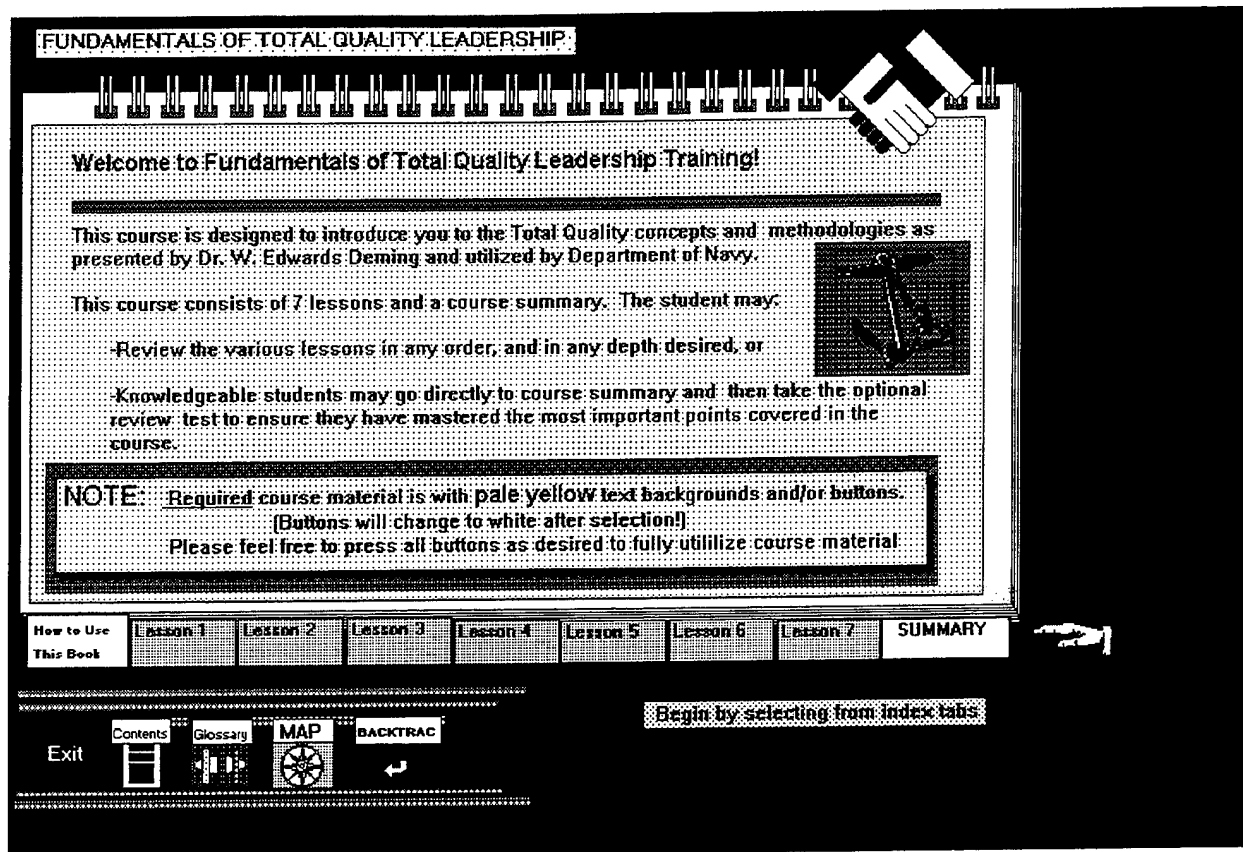


Figure 1 "Welcome" [storyboard p. 1]

"Summary" to "Summary" [storyboard p. 57] [optional]

"Lesson 1" to "Lesson 1 Objectives" [storyboard p. 2]

"Lesson 2" still under construction

"Lesson 3" still under construction

"Lesson 4" still under construction

"Lesson 5" still under construction

"Lesson 6" still under construction

"Lesson 7" still under construction

"How to Use this Book" [storyboard p. 80] discusses

Navigation Buttons (lower left) [see Figures 119-125, pp. 158-164]

Navigational Buttons (lower left of each page): [see Figures 126-129, pp. 165-168]

"Exit" to "Exit Choice" [storyboard p. 51]

"Contents" to "Index" (Main Menu) [storyboard p. 81]

"Glossary" to "Glossary" [storyboard p. 82] [Glossary gives short definition of terms]

"Map" to "Map" [storyboard p. 79] [Map shows every page; student can see which pages have already been reviewed, and can go to any other page]

"Backtrac" retraces all previous steps [all previous storyboard "pages" one at a time]

OBJECTIVESRecognize:

1. W. E. Deming's contribution to quality management
2. Dimensions of quality
3. The customer defines quality
4. All work is composed of processes
5. Quality is achieved through continuous process improvement
6. Definition of Total Quality Leadership
7. Deming's Chain reaction for Quality Improvement
8. Importance of a customer feedback system

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Figure 2 "Lesson Objectives" [storyboard p. 2]

"Continue" to "ADM Kelso" [storyboard p. 3]

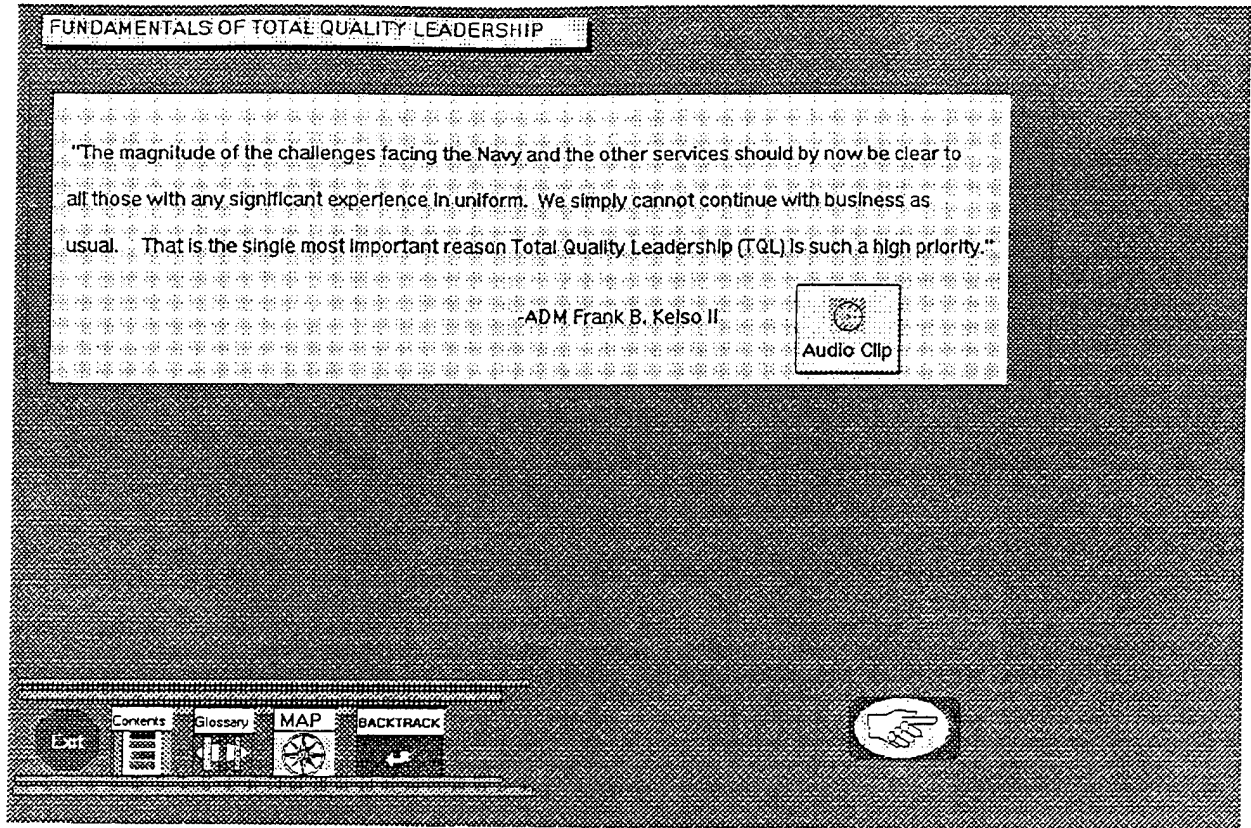


Figure 3 " ADM Kelso" [storyboard p. 3]

"Continue" to "Contribution" [storyboard p. 4]

"Audio" to Audio Clip

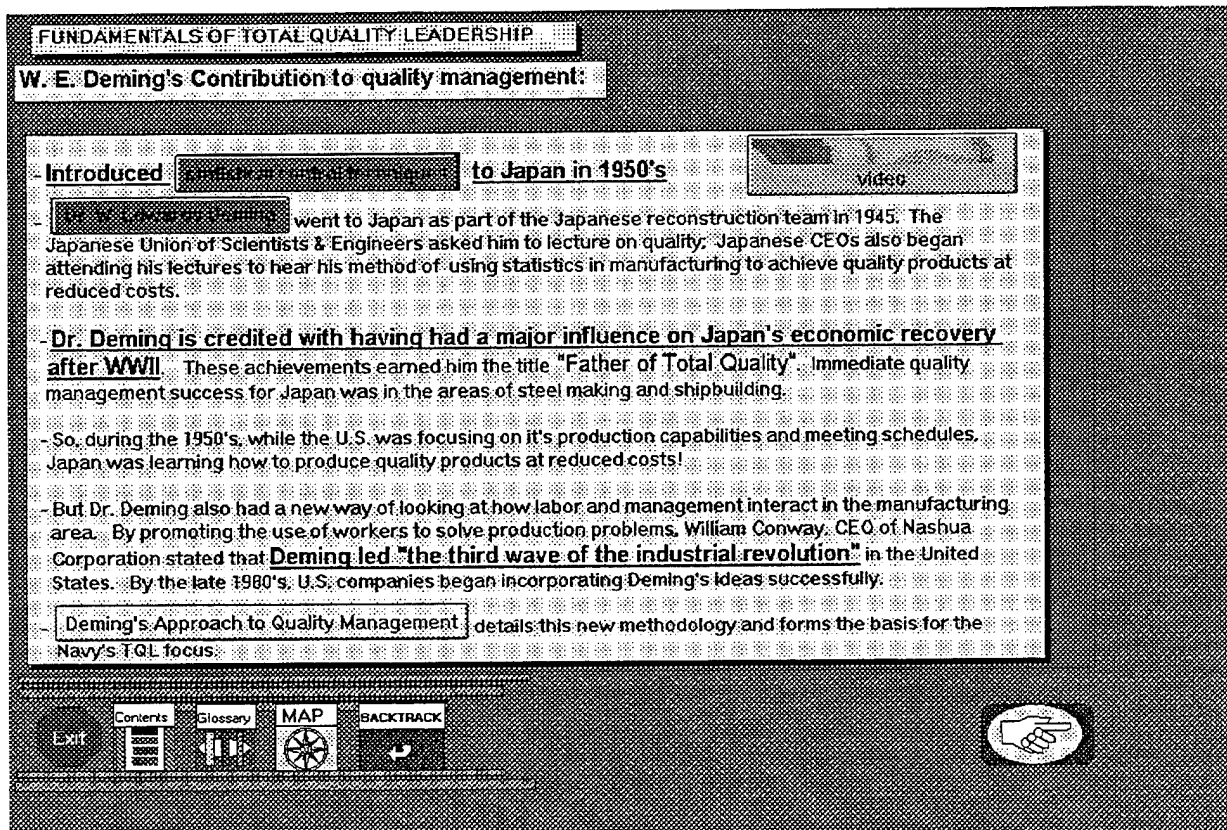


Figure 4 "Contribution" [storyboard p. 4]

"Statistical Control Techniques" to "SPC" [storyboard p. 35] [optional]

"Dr. W. Edwards Deming" to "Deming" [storyboard p. 34] [optional]

"Deming's Approach to Quality Management" to "Demings approach"
[storyboard p. 33] [optional]

"Continue" to "Think about quality" [storyboard p. 5]

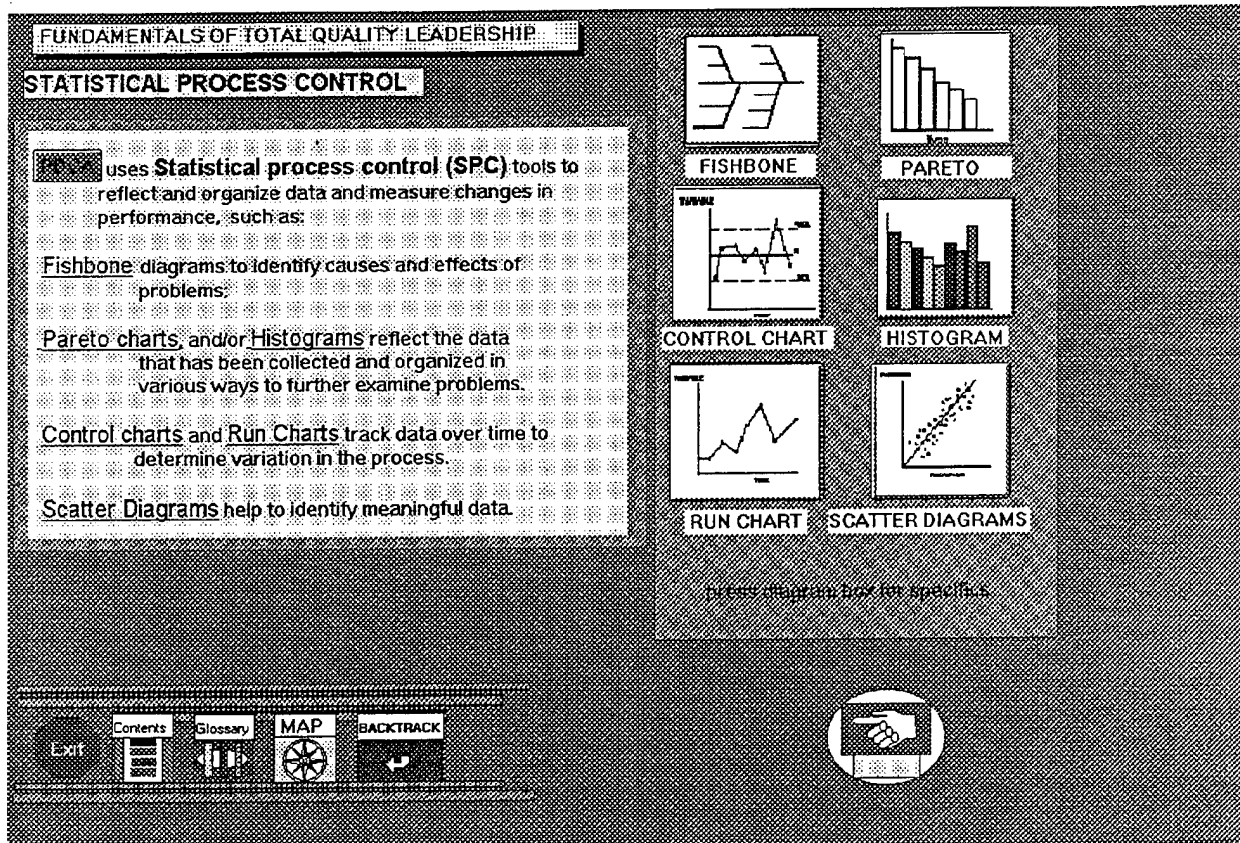


Figure 5 "SPC" [storyboard p. 35]

- Graphics button "Fishbone" to "Fishbone" [storyboard p. 37]
- Graphics button "Pareto" to "Pareto" [storyboard p. 36]
- Graphics button "Control Chart" [storyboard p. 40]
- Graphics button "Histogram" [storyboard p. 41]
- Graphics button "Run Chart" [storyboard p. 43]
- Graphics button "Scatter Diagrams" [storyboard p. 42]
- "Return" to "Contribution" [storyboard p. 4]
- "PDCA" to "PDCA" [storyboard p. 48]

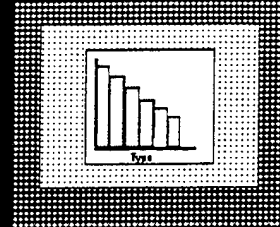
FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

PARETO CHART

The Pareto Chart is used to identify major factors in a subject being analyzed and highlight the "vital few" in contrast to the "trivial many". In other words, when you need to discover or display the relative importance of data or variables (problems, causes, or conditions). It may be used to examine the how, what, when, where, and why of a suspected problem cause and help teams to identify which are the most significant or frequent so they can work on these first.

This chart was developed in the late 1800s by Vilfredo Pareto, an Italian economist, who found that typically 80 percent of the wealth in a region was concentrated in less than 20 percent of the population.

The Pareto chart is a bar chart in which the data are arranged in descending order of importance, generally by magnitude of frequency, cost, time, or a similar parameter. It is like two charts (bar chart and pie chart) in one.



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Figure 6 "Pareto" [storyboard p. 36]

"Return" to "SPC" [storyboard p. 35]

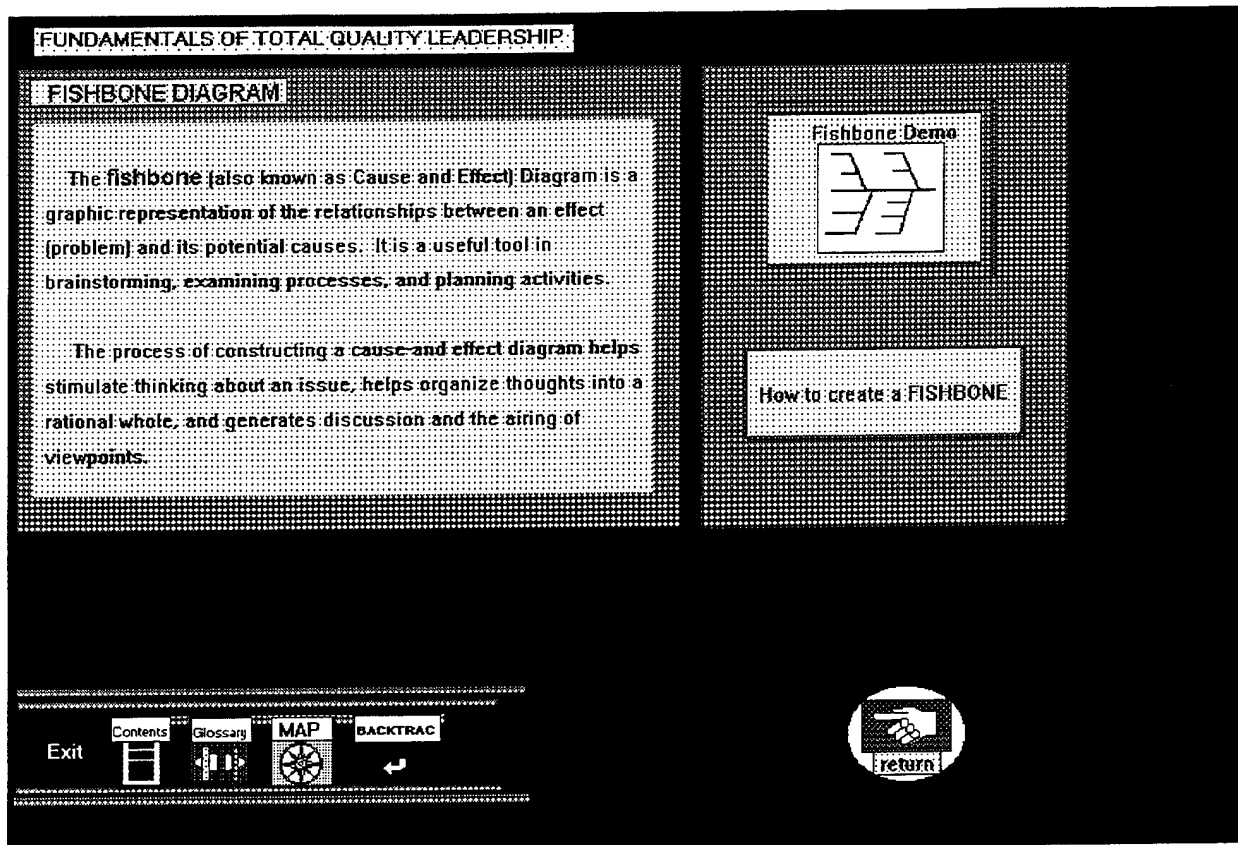


Figure 7 "Fishbone" [storyboard p. 37]

Graphics "Fishbone Demo" to "Fishbone-Auto" [storyboard p. 39] [optional]
 "How to Create a Fishbone in Text Format" to "Fishbone Steps" [storyboard p. 38]
 [optional]
 "Return" to "SPC" [storyboard p. 35]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

How to create a FISHBONE diagram in 10 steps:

1. Define the effect or current situation as clearly as possible. You can always go back and refine it later as you collect new data. Write the effect in the head of the fish.
2. Begin by brainstorming causes and listing them on a flip chart in no particular order. When the group runs dry of ideas, they look for categories and similarities suggested by the list. These major categories, or themes, become the big bones.
3. To encourage lots of ideas, ask "Why? Why? Why?" When the answers begin to sound silly, you can stop.
4. Draw the major bones and label them. You may decide on three, four, or more major themes. Use generic branches (people, methods, materials, machines) if helpful.
5. Place the causes from the brainstorm list as small bones under the appropriate big bone.
6. Allow the organization of the brainstormed causes to stimulate other ideas for causes. The group should be encouraged to add as many potential causes as possible. For each cause identified, ask, "What caused this?"
7. Have the group highlight the cause(s) they believe to be contributing to the effect.
8. To verify causes, you will need to collect information to either accept or reject them.
9. Work on most important causes (for example, apply design of experiments methods).
10. Desensitize, eliminate, or control causes.

Exit



Figure 8 "Fishbone Steps" [storyboard p. 38]

"Return" to "Fishbone" [storyboard p.37]

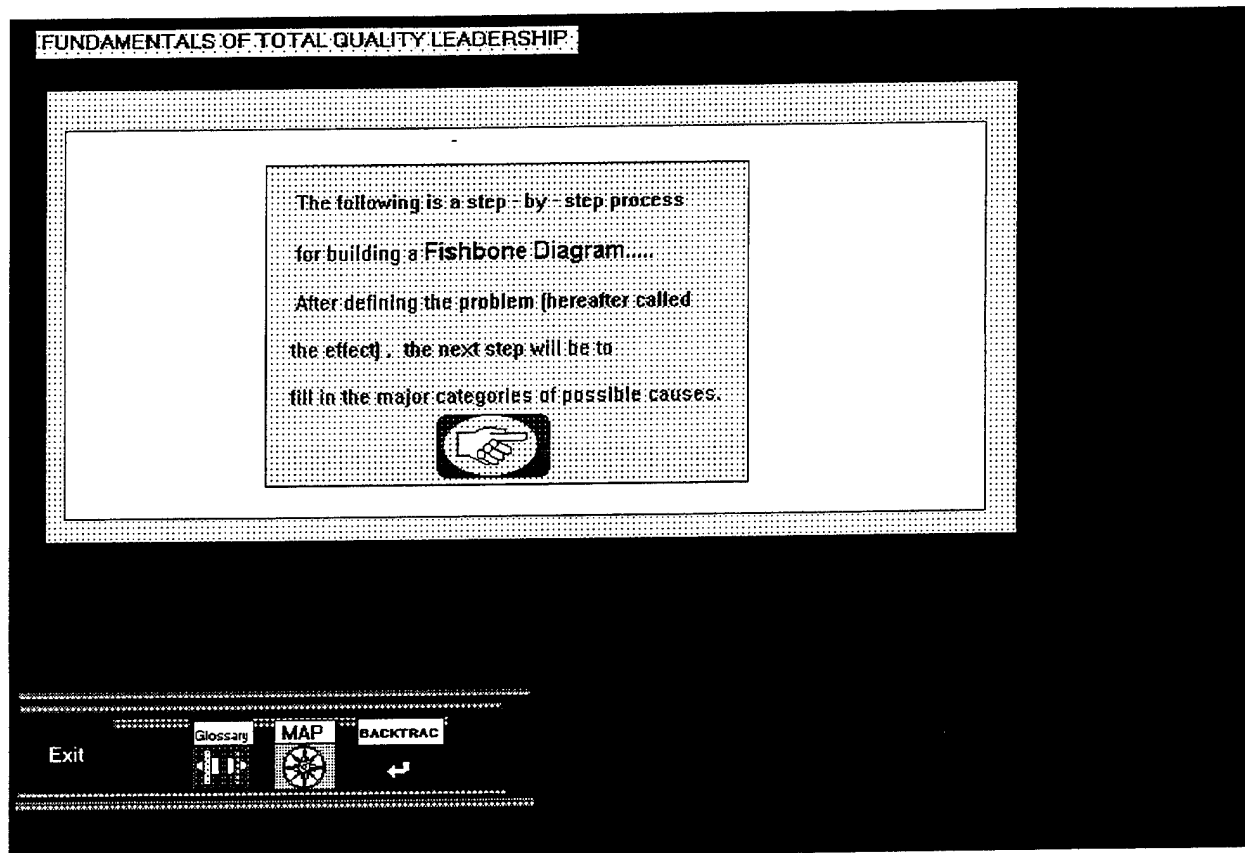


Figure 9 "Fishbone-Auto" [storyboard p. 39]

This page consists of 5 steps which the "continue" button drives...

"Continue" to step 1 of 5

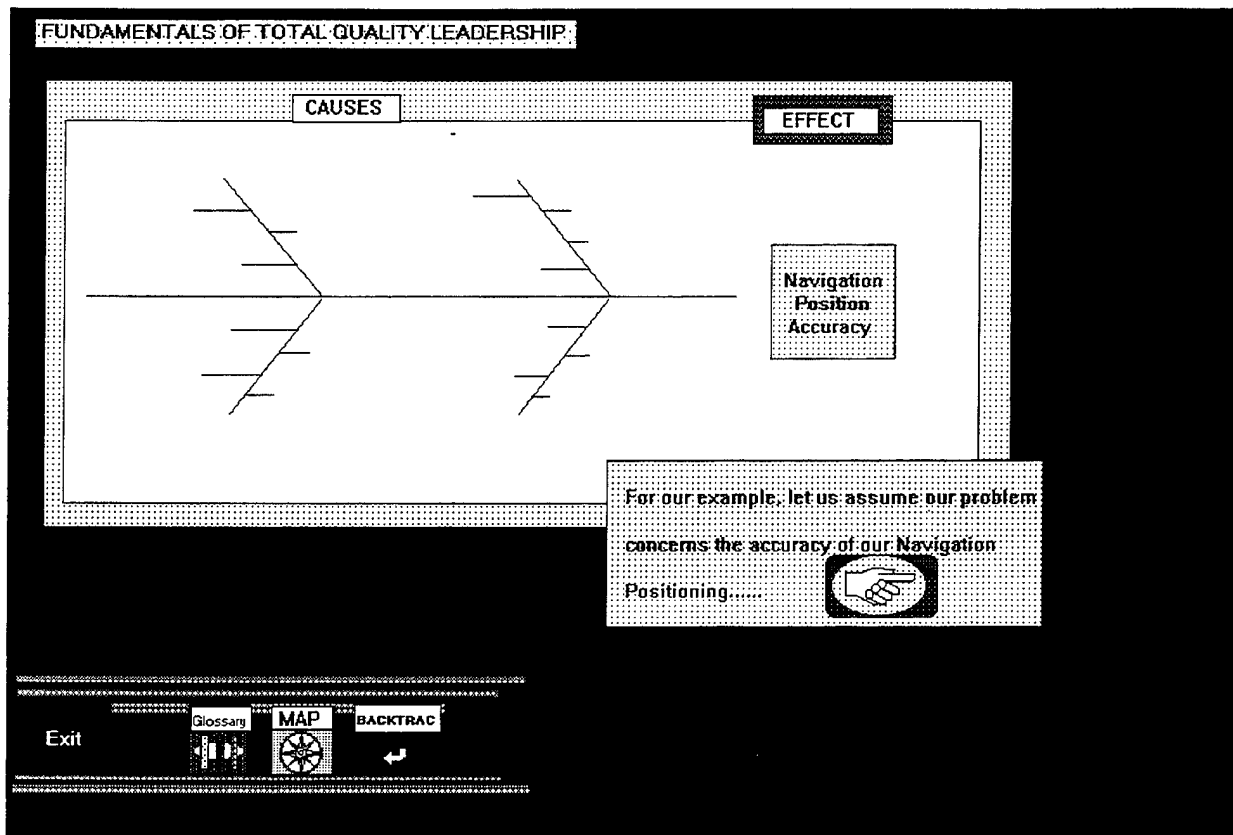


Figure 10 "Fishbone-Auto" [storyboard p. 39] [step 1 of 5]

"Continue" to step 2 of 5

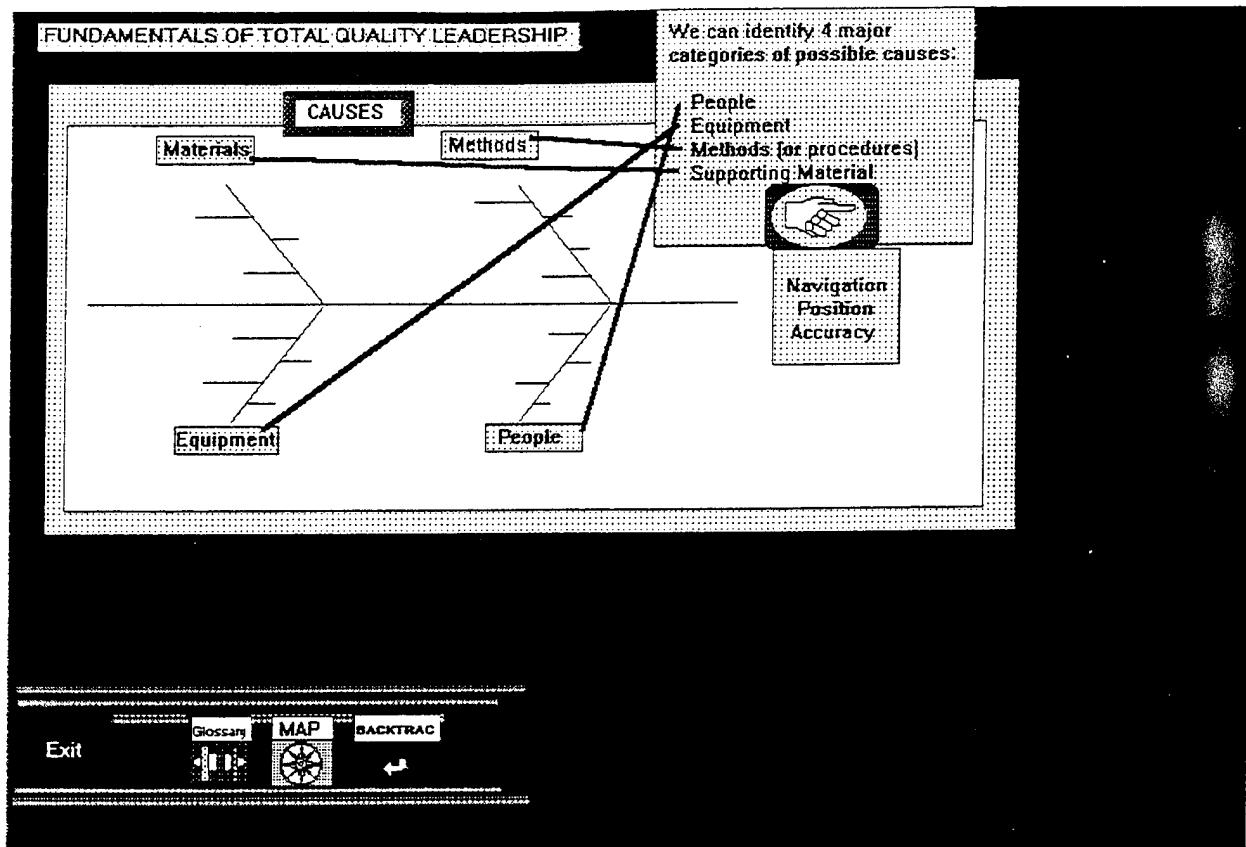


Figure 11 "Fishbone-Auto" [storyboard p. 39] [step 2 of 5]

"Continue" to step 3 of 5

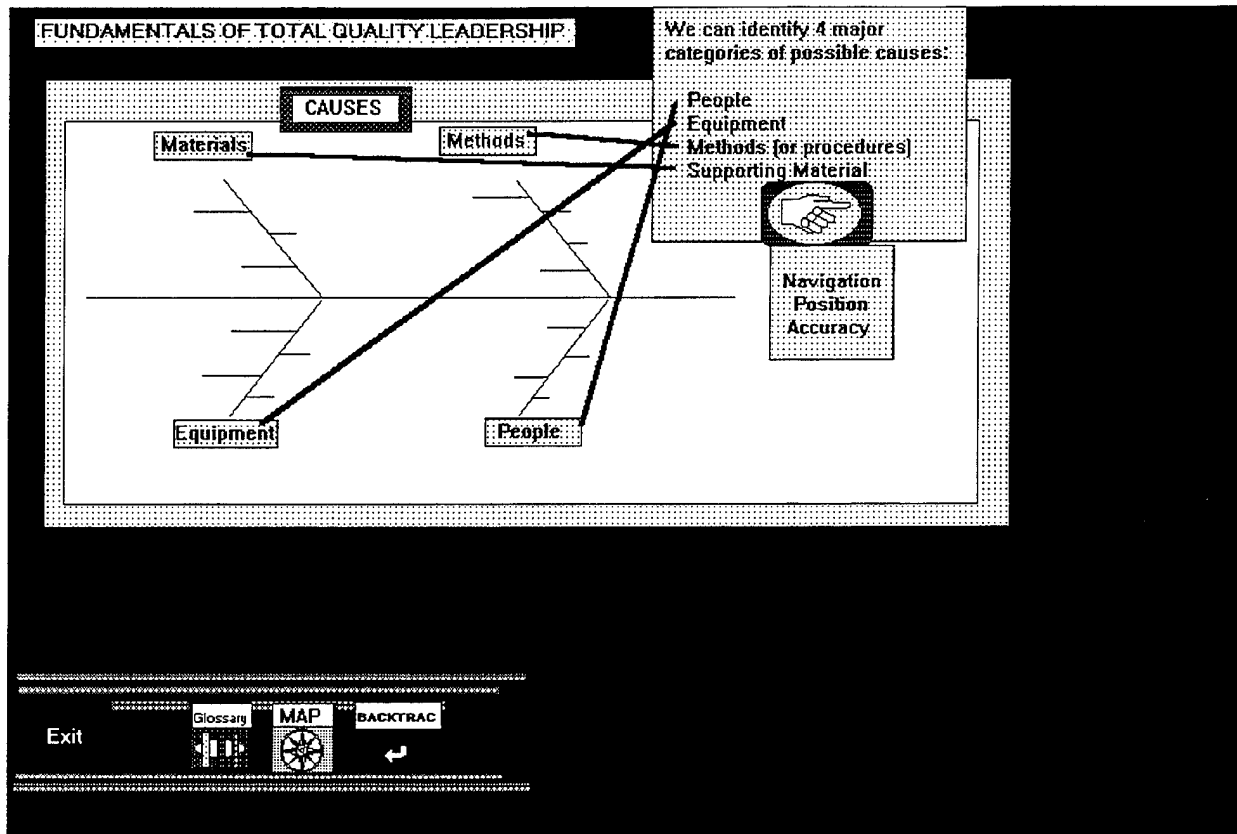


Figure 12 "Fishbone-Auto" [storyboard p. 39] [step 3 of 5]

"Continue" to step 4 of 5

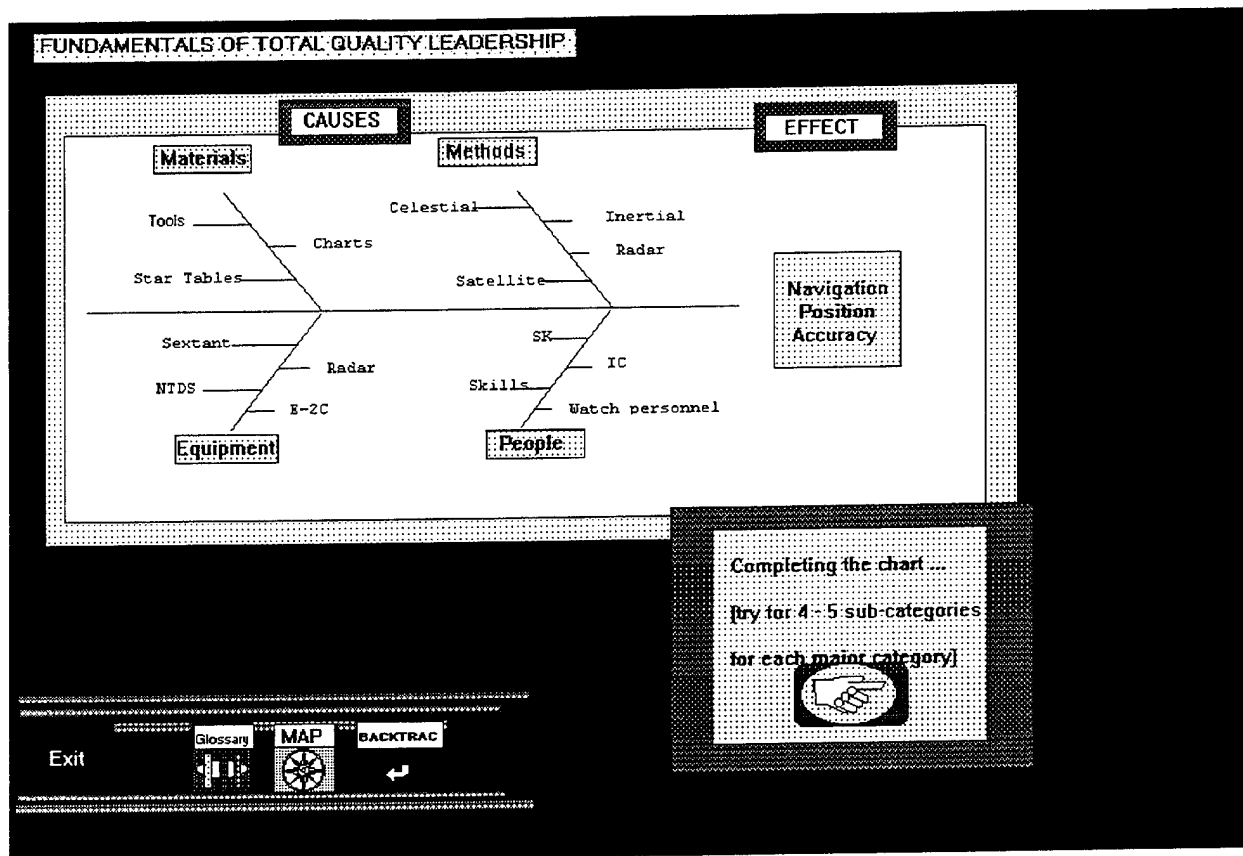
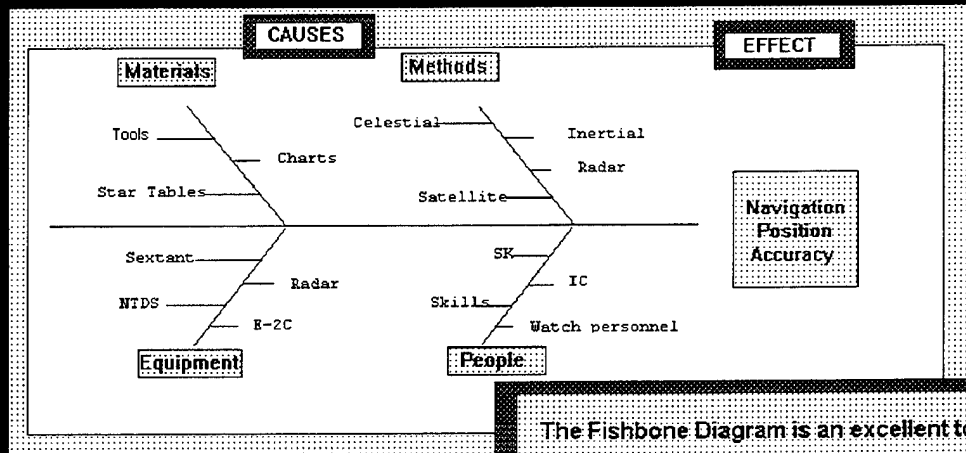


Figure 13 "Fishbone-Auto" [storyboard p. 39] [step 4 of 5]

"Continue" to step 4 of 5

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP



The Fishbone Diagram is an excellent tool to show the relationships between a given effect and its possible causes. It helps to sort out and relate the interactions among the factors affecting a process.



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Figure 14 "Fishbone-Auto" [storyboard p. 39] [step 5 of 5]

"Return" to "Fishbone-Auto" [storyboard p. 39]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

CONTROL CHART

A control chart is used to monitor the performance of a process with frequent outputs. It provides a pictorial representation of an ongoing process and is based on four concepts:

- All processes fluctuate with time
- Individual points in the process are unpredictable.
- A stable process fluctuates randomly, and groups of points from a stable process tend to fall within predictable bounds.
- An unstable process does not fluctuate randomly, and these fluctuations are generally out of the range of normal operations.

Control charts help you understand the inherent capability of your processes, bring your processes under control by eliminating the special causes of variation, reduce tampering with processes that are under statistical control, and monitor the effects of process changes aimed at improvement.

CONTROL CHART DEMO

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Figure 15 "Control" [storyboard p. 40]

"Return" to "SPC" [storyboard p.35]

"Control Chart Demo" still under construction

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

HISTOGRAM

A histogram is a visual representation of the spread or dispersion of variable data (for example, the number of defects per lot). In histograms there is a tendency for many items to fall in the center of the distribution (central tendency), with progressively fewer items as you move from the center.

In a histogram, the data are represented by a series of rectangles, or bars, proportional in height to the frequency of the group or class represented. Since class intervals (but not number) will be equal in size, the rectangles are of equal width. The heights of the rectangles relative to one another indicate the proportion of data points in each class.

Histograms help to identify changes or shifts in processes as changes are made. Histograms show how measurements of a process or product can vary, and thus, they help in establishing standards. Once standards have been set, measurements can be compared to these standards.

HISTOGRAM DEMO



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Figure 16 "Histogram" [storyboard p. 41]

"Return" to "SPC" [storyboard p. 35]

"Histogram Demo" still under construction

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

SCATTER DIAGRAMS

Scatter diagrams and their related correlation analysis permit you to examine two factors at one time and determine the relationship that may exist between them. The graphic display can help you determine the possible causes of problems, even when the linkage between the factors is counterintuitive. The pattern or distribution of data points in a scatter diagram describes the strength of the relationship between the factors being examined. However, even a strong correlation does not necessarily imply a cause-and-effect relationship between the factors. Additional work may be required to uncover the nature of the indicated relationship.

The scatter diagram shows plotted points against two measures: one displayed on the vertical (y) axis, the other on the horizontal (x) axis. The visual pattern of the plotted points gives quick information about the presence of a relationship or correlation.

If you see a correlation (either positive or negative) between two measures, you can assume that if you can change the incidence of one measure, the other will move as well.

SCATTER DIAGRAM DEMO



Figure 17 "Scatter" [storyboard p. 42]

"Return" to "SPC" [storyboard p. 35]

"Scatter Diagram Demo" still under construction

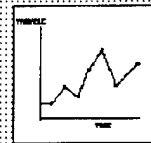
FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

RUN CHART

The run chart is a graphic display of changes over some period of time. The left scale is a quantity, percentages or simple counts of frequency. The horizontal line is divided into time intervals such as days of the week, months, or even an ordinal sequence such as first job, second job, and so on.

The line that joins the plot marks gives a moving picture of the fluctuations over time. Defect rates are reported on time lines in order to spot trends.

RUN CHART DEMO



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Figure 18 "Run Chart" [storyboard p. 43]

"Return" to "SPC" [storyboard p. 35]

"Run Chart Demo" still under construction

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

Dr. W. Edwards Deming:

Born in 1893, and recipient of a Ph.D. in mathematics and physics from Yale, W. Edwards Deming was first introduced to the basic tenets of traditional management principles in the late 1920's, as a summer employee at Western Electric's famous Hawthorne plant in Chicago. At the Hawthorne plant the revolutionary human relations studies of Harvard Professor Elton Mayo began to raise a fundamental question: how can organizations best motivate workers? Deming found the traditional motivation system in use at that time to be degrading and economically unproductive.

Following the war, Deming left government service and set up a private consulting practice. The State Department, one of his early clients, sent him to Japan in 1947 to help prepare a national census in that devastated country. U.S. managers soon forgot their wartime statistical control lessons and continued their prewar love affair with traditional management practices, which prized production over quality management.

During the 1930's, Deming's collaboration with Walter a. Shewhart, a statistician working at Bell Laboratories, led to Deming's conviction that traditional management methods should be replaced with statistical control techniques. Deming recognized that a statistically controlled management process gave the manager a systematic capacity to determine when to intervene and, equally important, when to leave an industrial process alone.

The Japanese credit part of their postwar industrial renaissance to Deming's statistical process control (SPC) - based philosophy of quality management. Dr. Deming died in 1993.

The above information was provided by: "Quality Management for Government", by V. Daniel Hunt, copyright 1992 by Technology Research Corporation.

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return

Figure 19 "Deming" [storyboard p. 34]

"Return" to "Contribution" [storyboard p. 4]

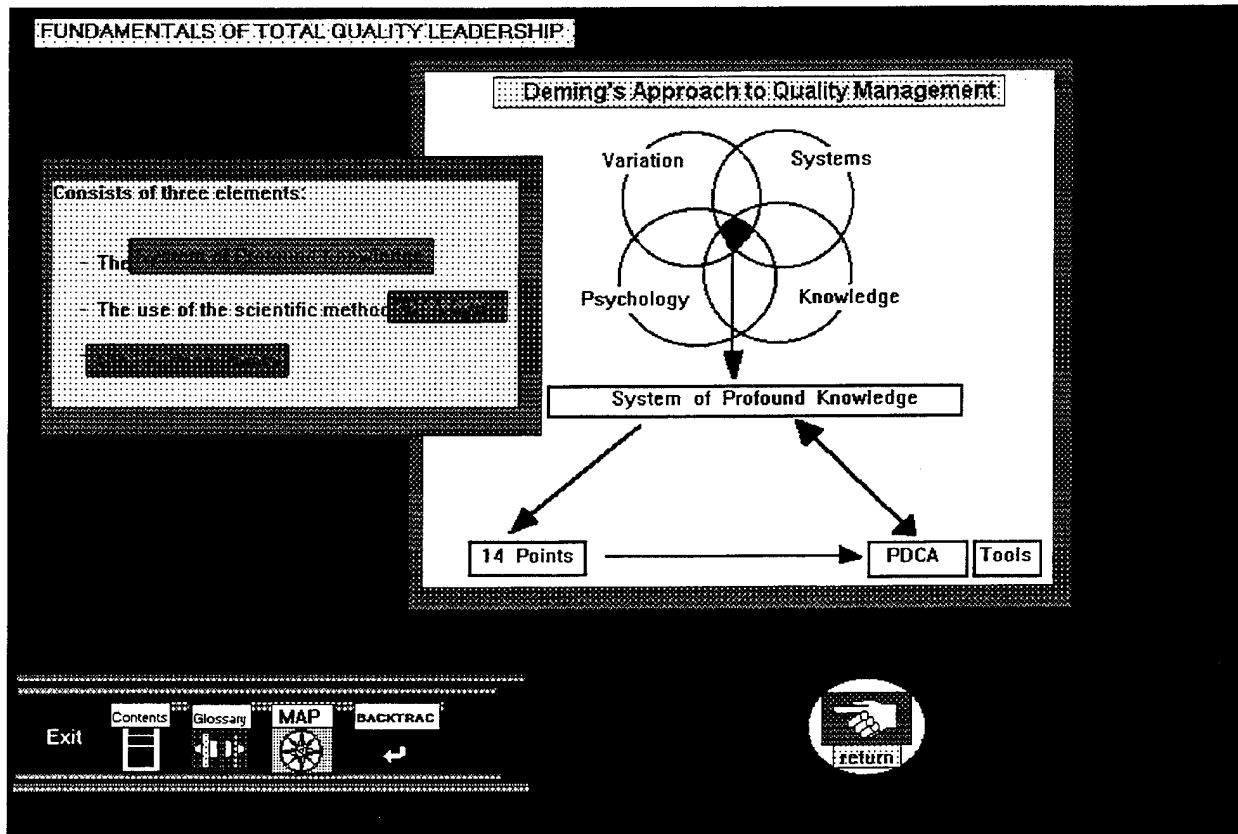


Figure 20 "Demings Approach" [storyboard p. 33]

"System of Profound Knowledge" to "Profound" [storyboard p. 45] [optional]

"PDCA Cycle" to "PDCA" [storyboard p. 48] [optional]

"The Fourteen Points" to "14 PTS" [storyboard p. 47] [optional]

"Return" to "Contribution" [storyboard p. 4]

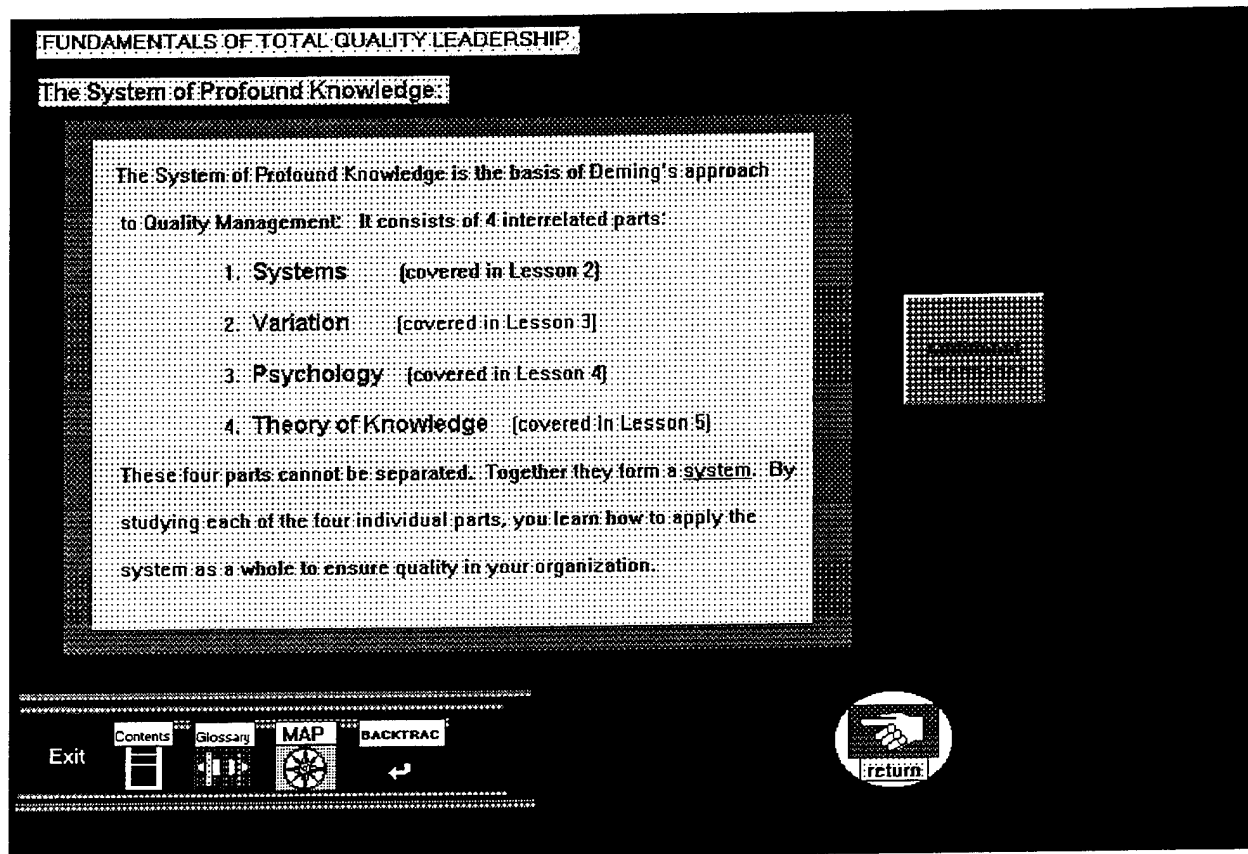


Figure 21 "Profound" [storyboard p. 45]

"Additional Information" to "Knowledge" [storyboard p. 46] [optional]
"Return" to "Deming's Approach" [storyboard p. 33]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

PROFOUND KNOWLEDGE

Deming's philosophy of quality is essentially a philosophy of management, a philosophy of leadership. His ideas are simple, yet complex. Indeed, entire books have been written in attempts to explain and interpret them. The underlying principles of Deming's philosophy are summarized in what he calls "A System of Profound Knowledge." If one understands and applies these principles, then *leadership* naturally follows.

Profound Knowledge consists of four parts, all related to each other:

1. appreciation for a system
2. theory of variation
3. theory of knowledge
4. psychology

Appreciation for a System: A system is a series of functions or activities within an organization that work together for the aim of the organization. The components of any system must work together for the system to be effective. With cooperation, a key theme in the Deming philosophy, all the people that work within a system can contribute to improvement and thus enhance their joy in work. To manage any system, managers must understand the interrelationships among all components of the system and of the people that work in it.

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Figure 22 "Knowledge" [storyboard p. 46]

"Return" to "Profound" [storyboard p. 45]

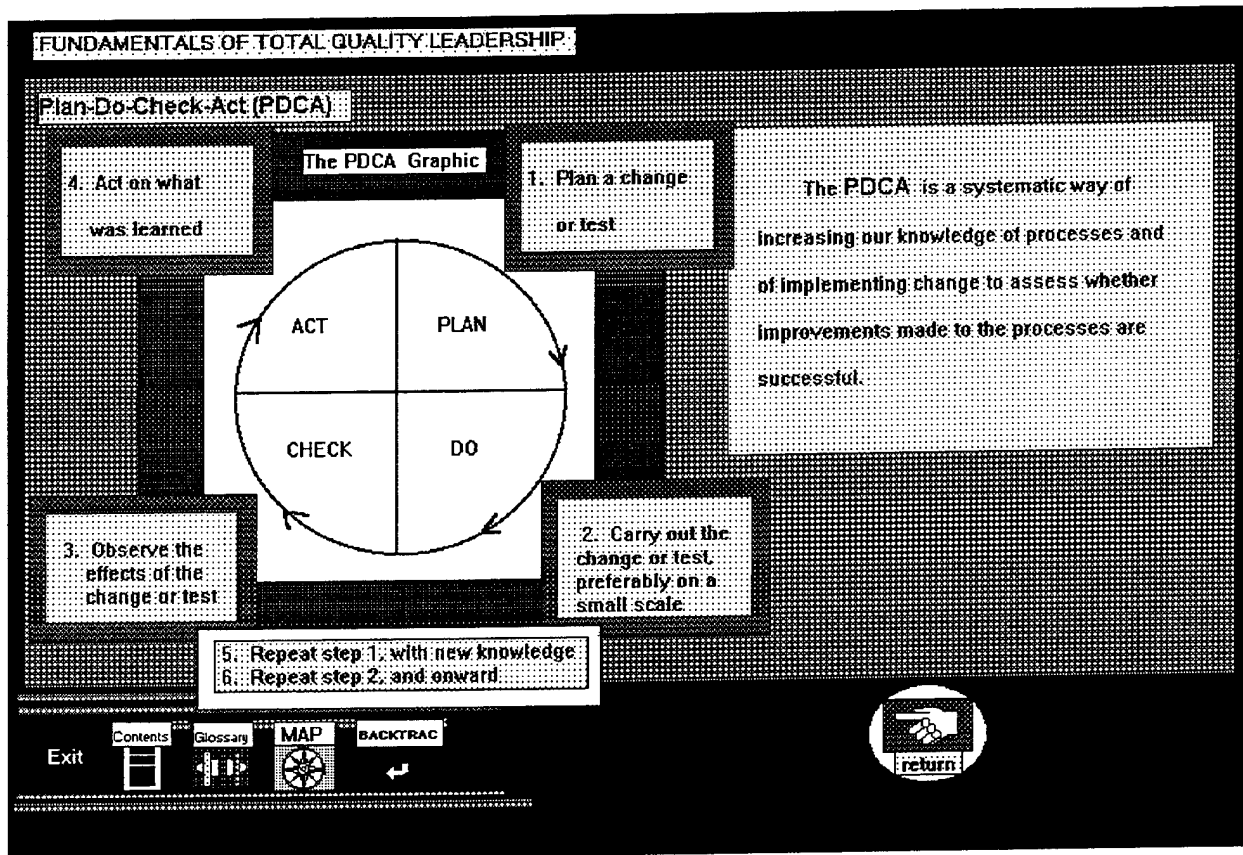


Figure 23 "PDCA" [storyboard p. 48]

"Return" to "Demings Approach" [storyboard p. 33]

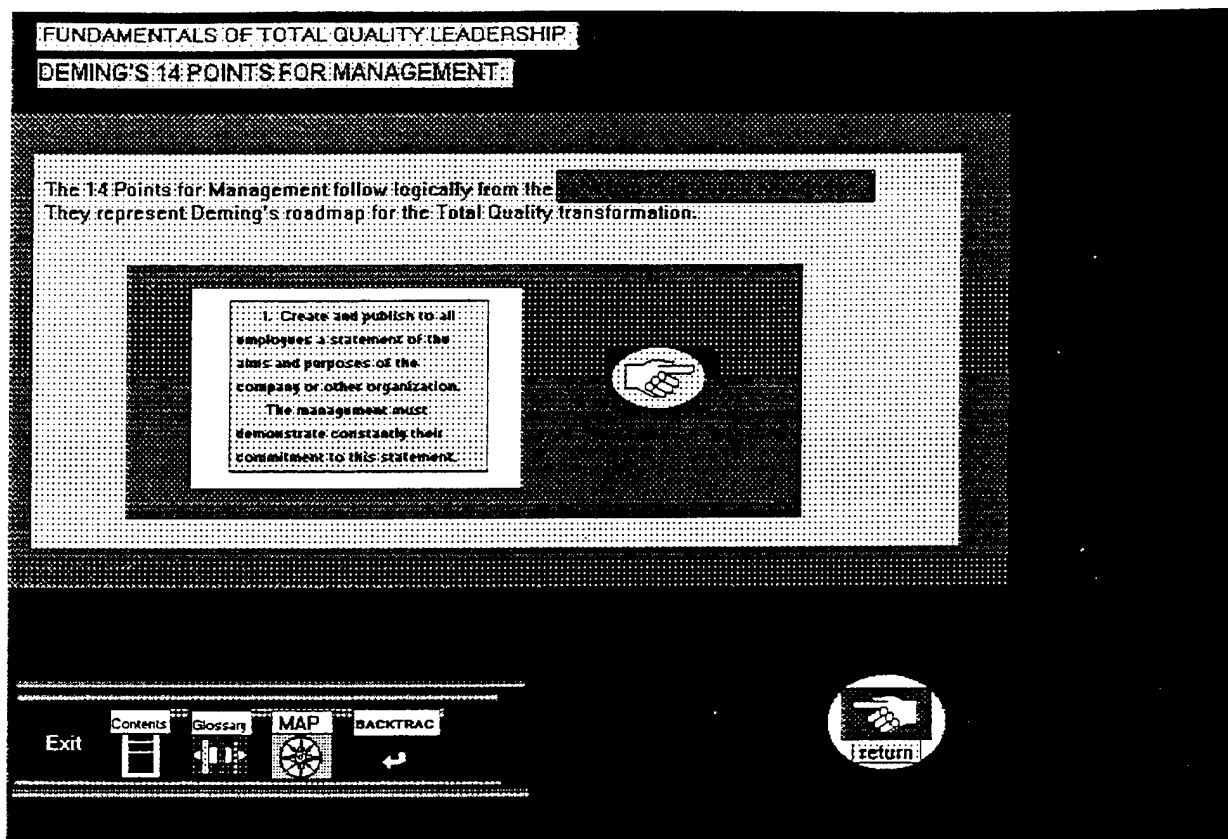


Figure 24 "14 PTS" [storyboard p. 47] [step 1 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 2 of 14]

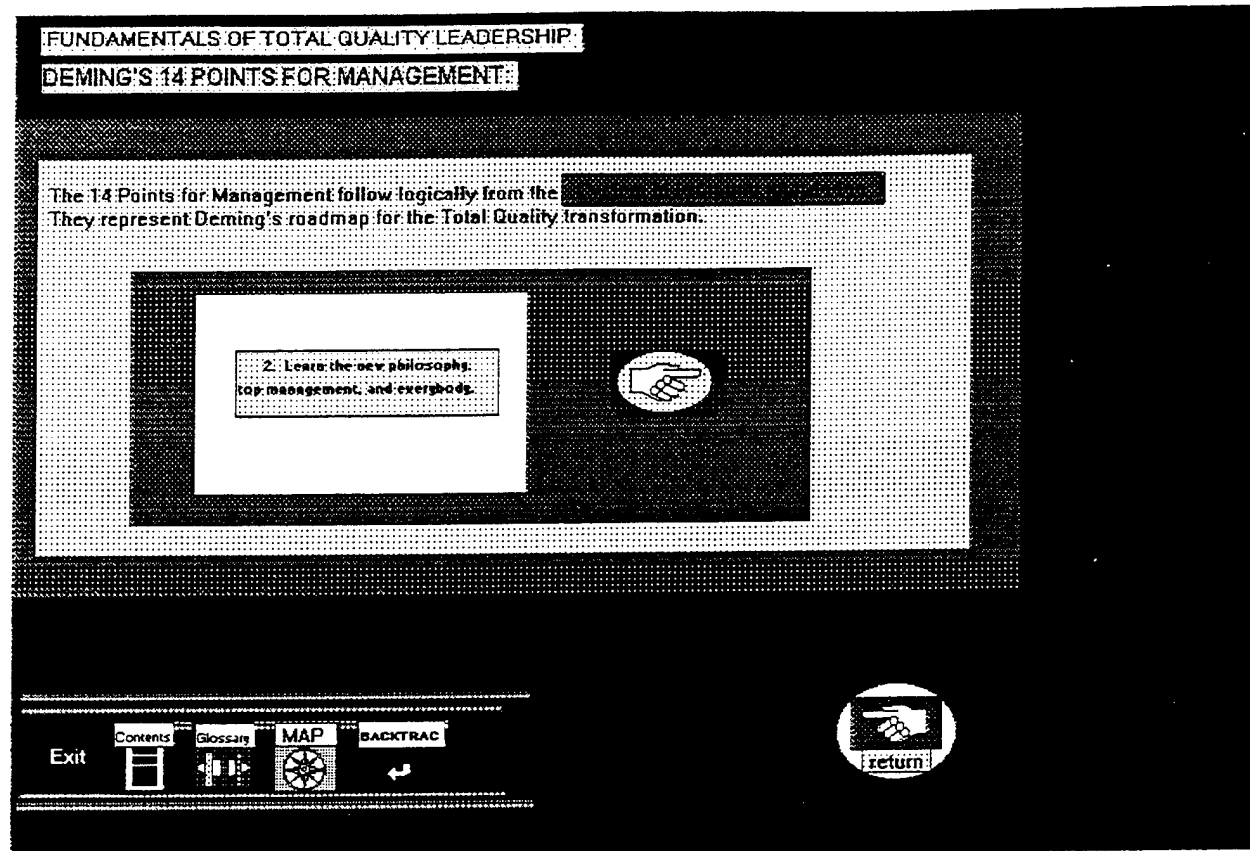


Figure 25 "14 PTS" [storyboard p. 47] [step 2 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 3 of 14]

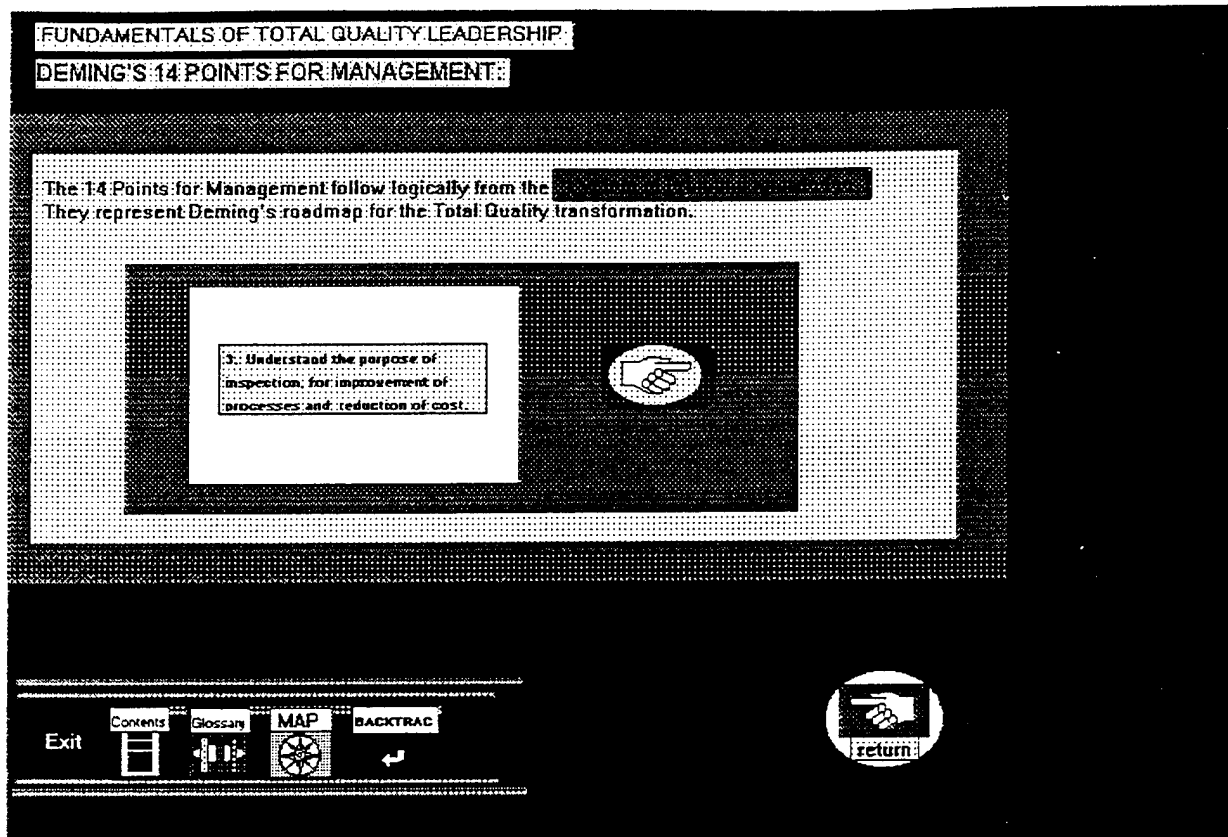


Figure 26 "14 PTS" [storyboard p. 47] [step 3 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 4 of 14]

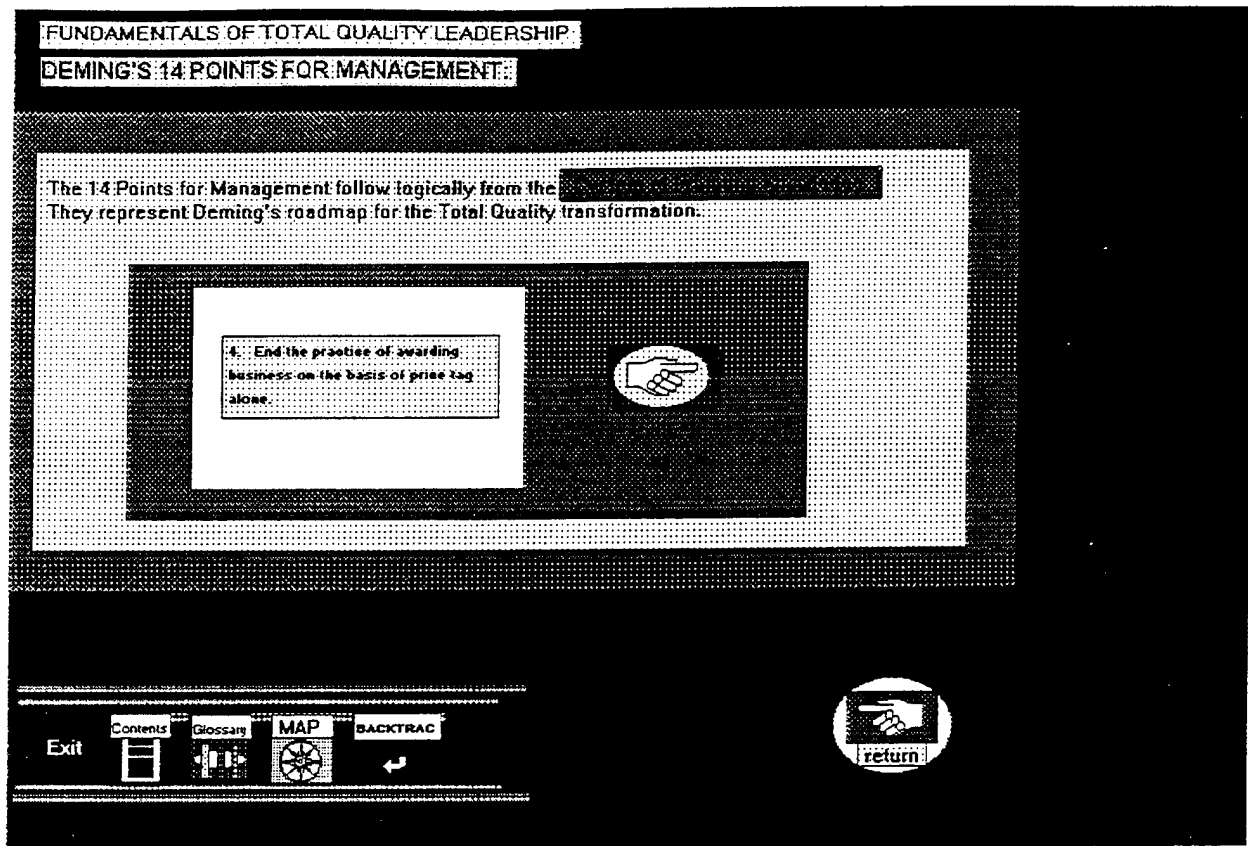


Figure 27 "14 PTS" [storyboard p. 47] [step 4 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 5 of 14]

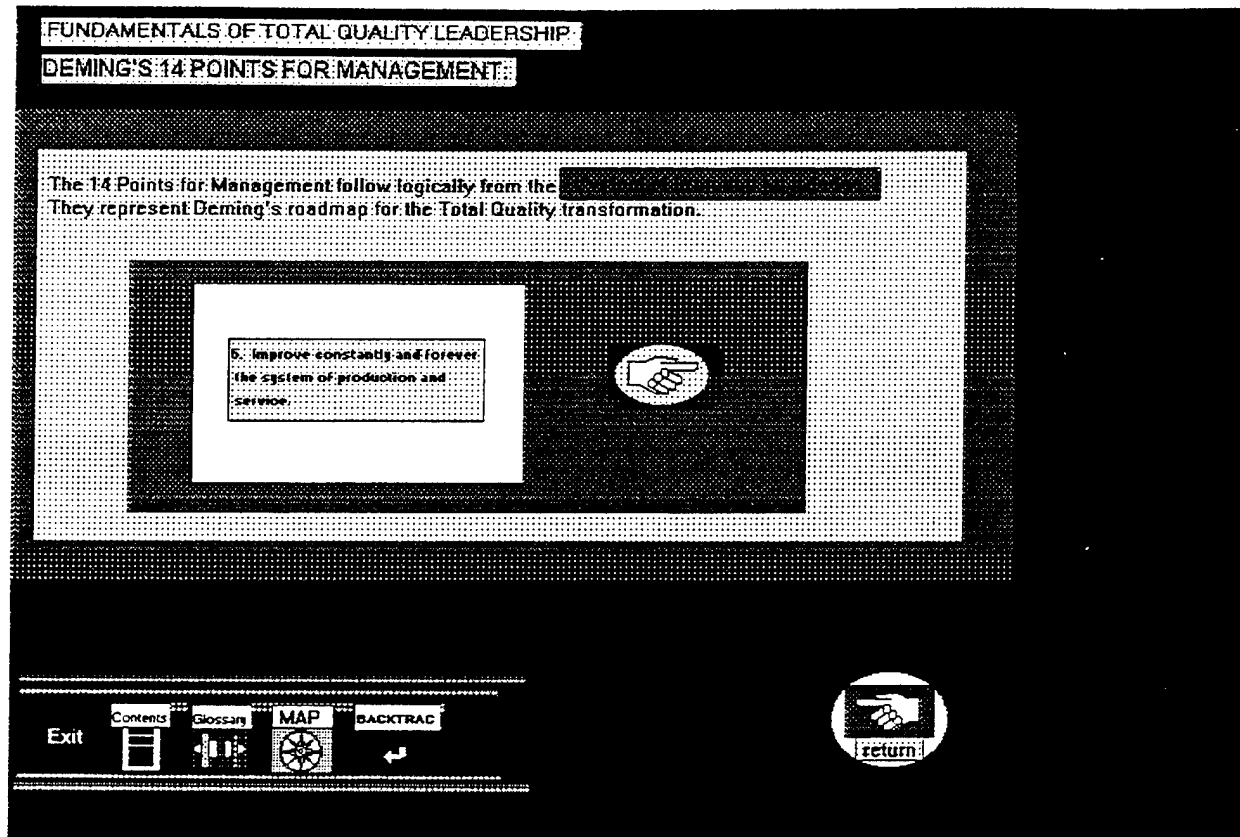


Figure 28 "14 PTS" [storyboard p. 47] [step 5 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 6 of 14]

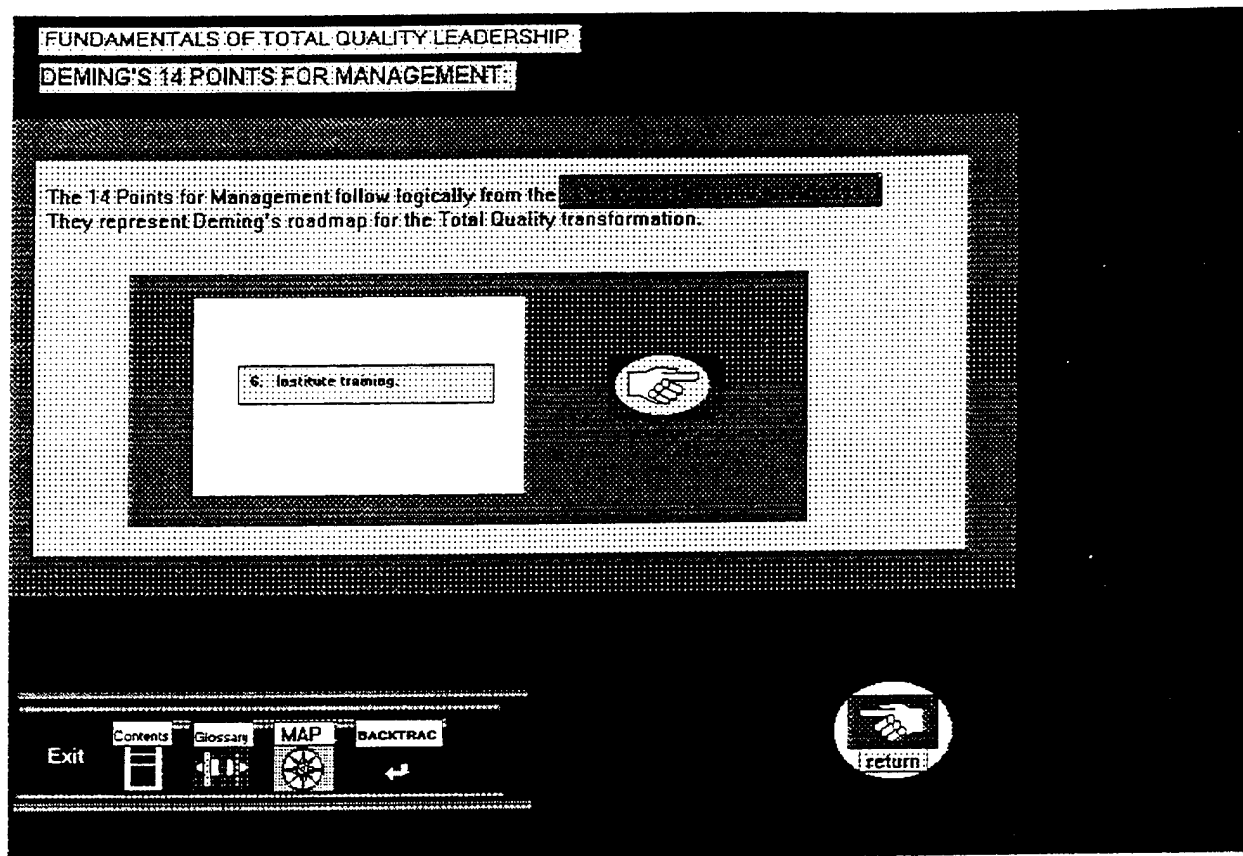


Figure 29 "14 PTS" [storyboard p. 47] [step 6 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 7 of 14]

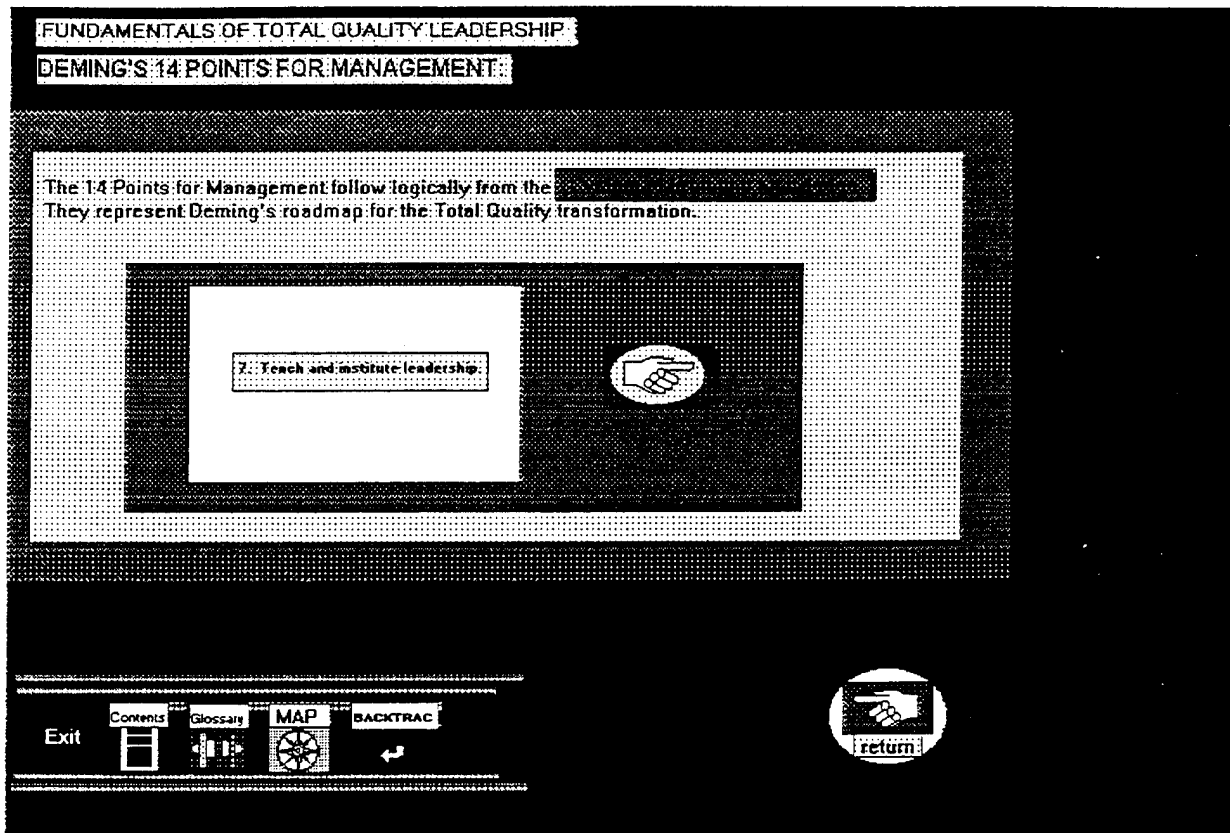


Figure 30 "14 PTS" [storyboard p. 47] [step 7 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 8 of 14]

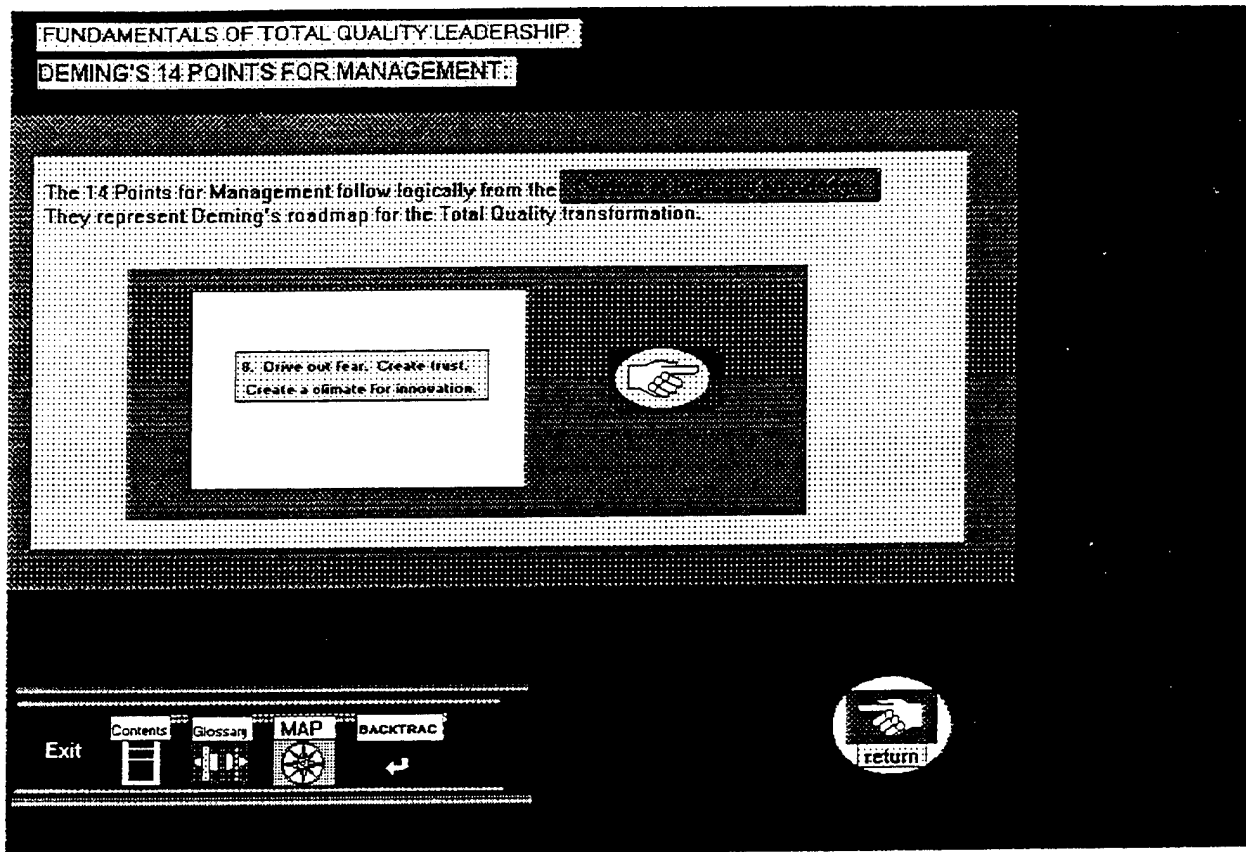


Figure 31 "14 PTS" [storyboard p. 47] [step 8 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 9 of 14]

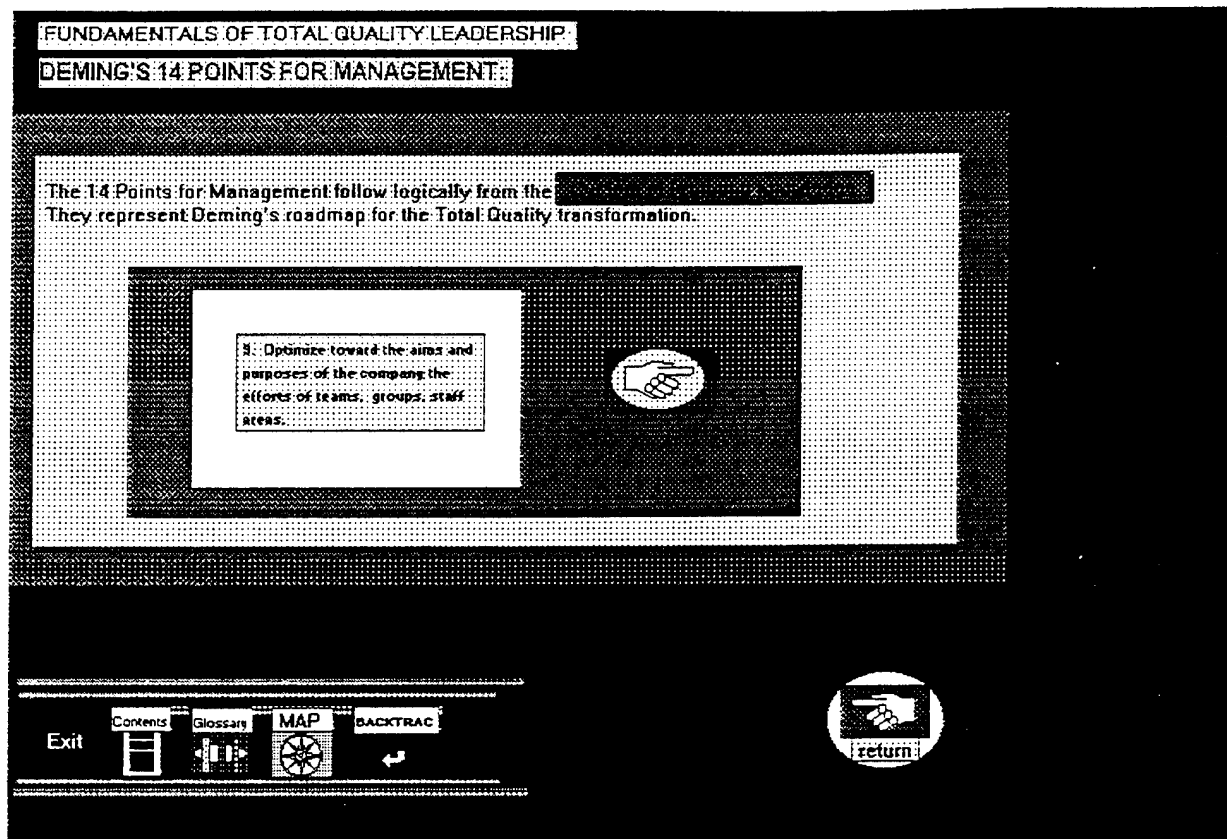


Figure 32 "14 PTS" [storyboard p. 47] [step 9 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 10 of 14]

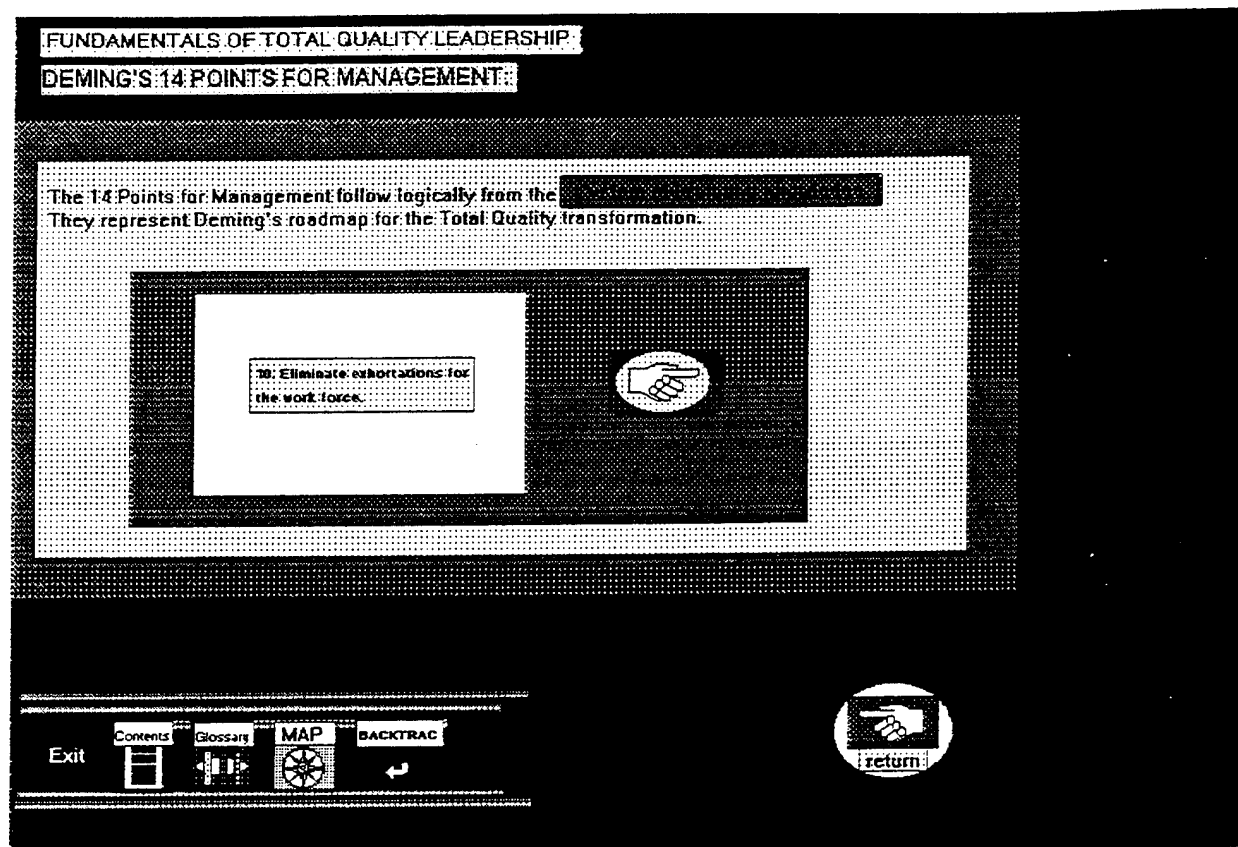


Figure 33 "14 PTS" [storyboard p. 47] [step 10 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 11 of 14]

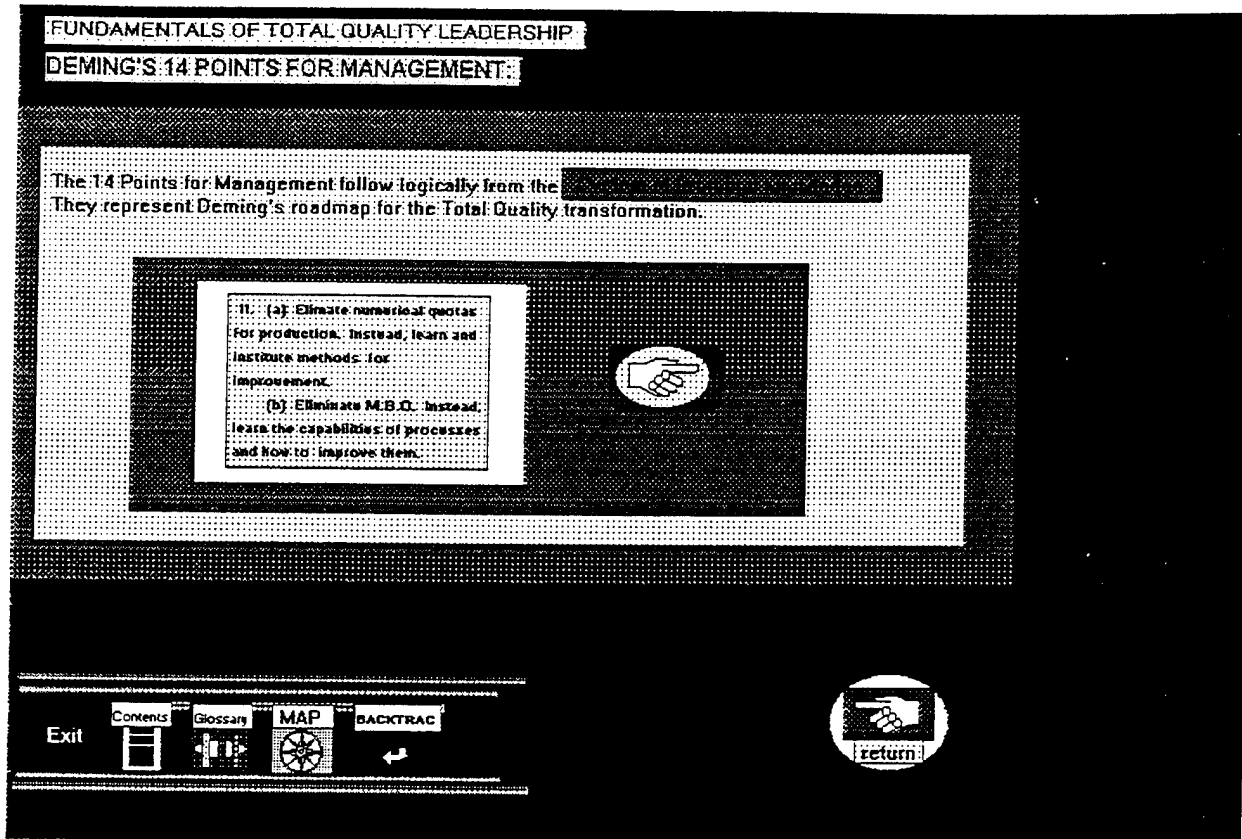


Figure 34 "14 PTS" [storyboard p. 47] [step 11 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 12 of 14]

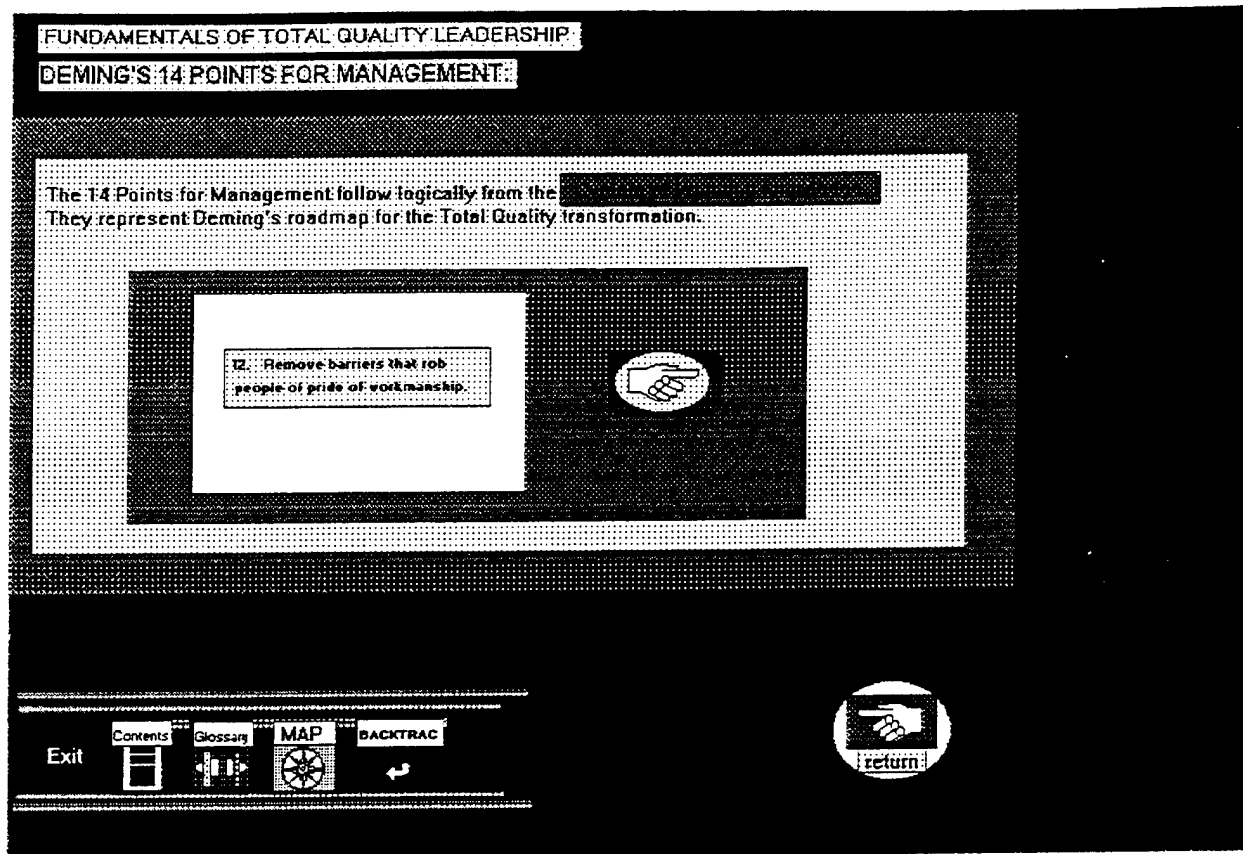


Figure 35 "14 PTS" [storyboard p. 47] [step 12 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 13 of 14]

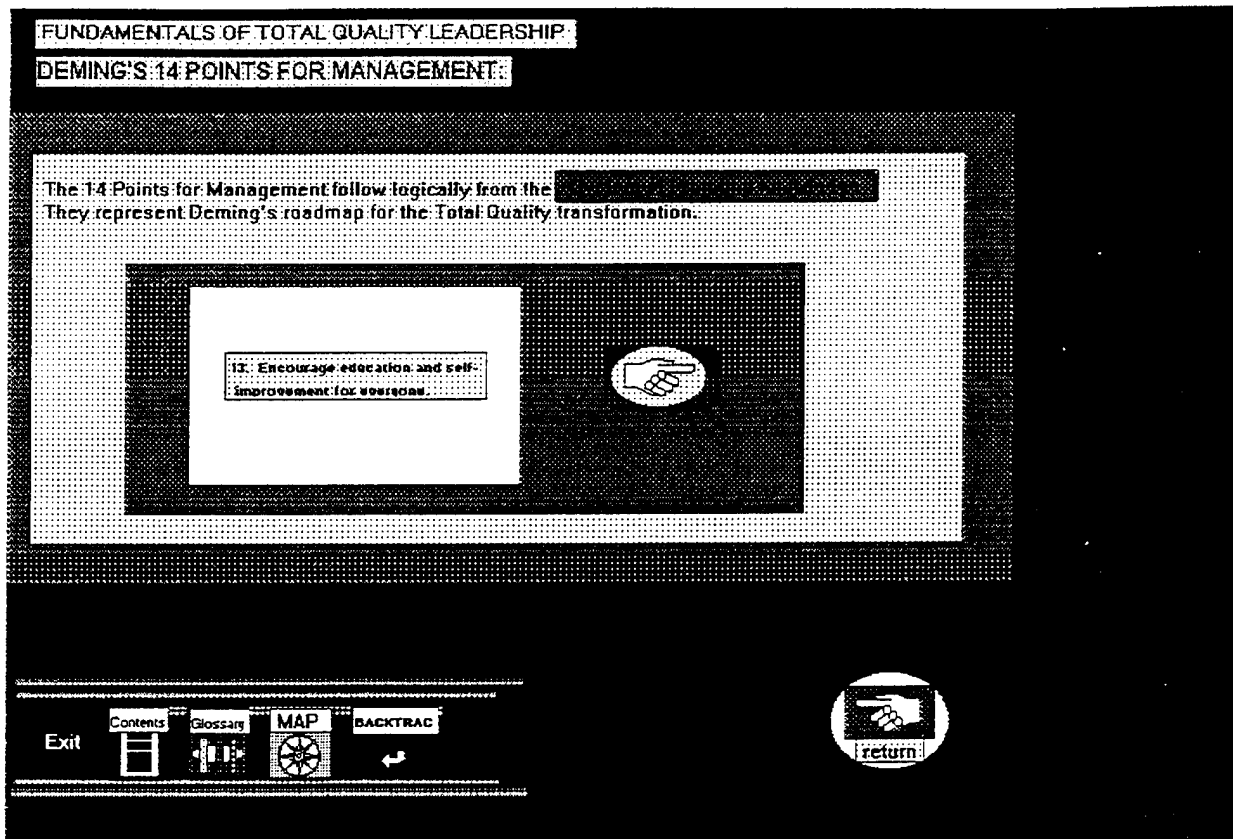


Figure 36 "14 PTS" [storyboard p. 47] [step 13 of 14]

"Continue" to "14 PTS" [storyboard p. 47] [step 14 of 14]

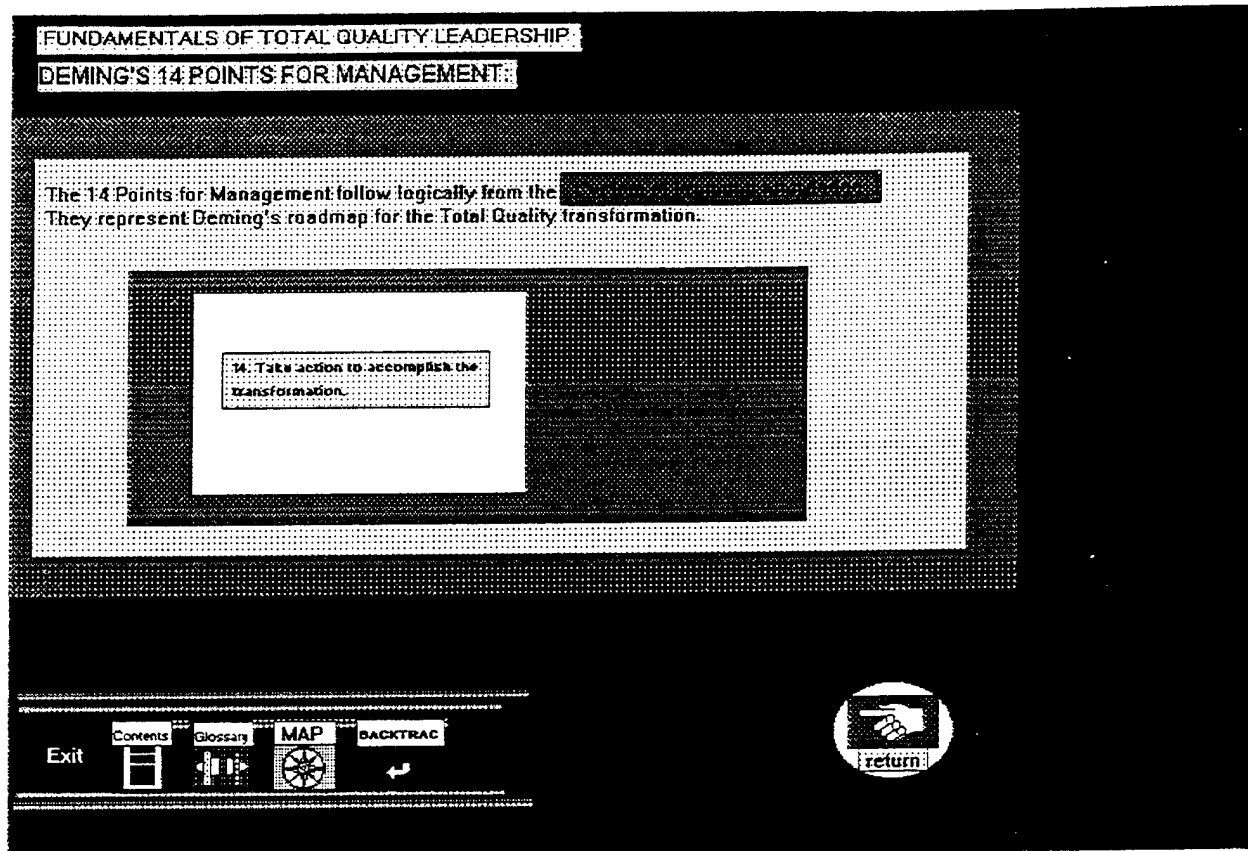


Figure 37 "14 PTS" [storyboard p. 47] [step 14 of 14]

"System of Profound Knowledge" to "Profound" [storyboard p. 45] [optional]
"Return" to "Demings Approach" [storyboard p. 33]

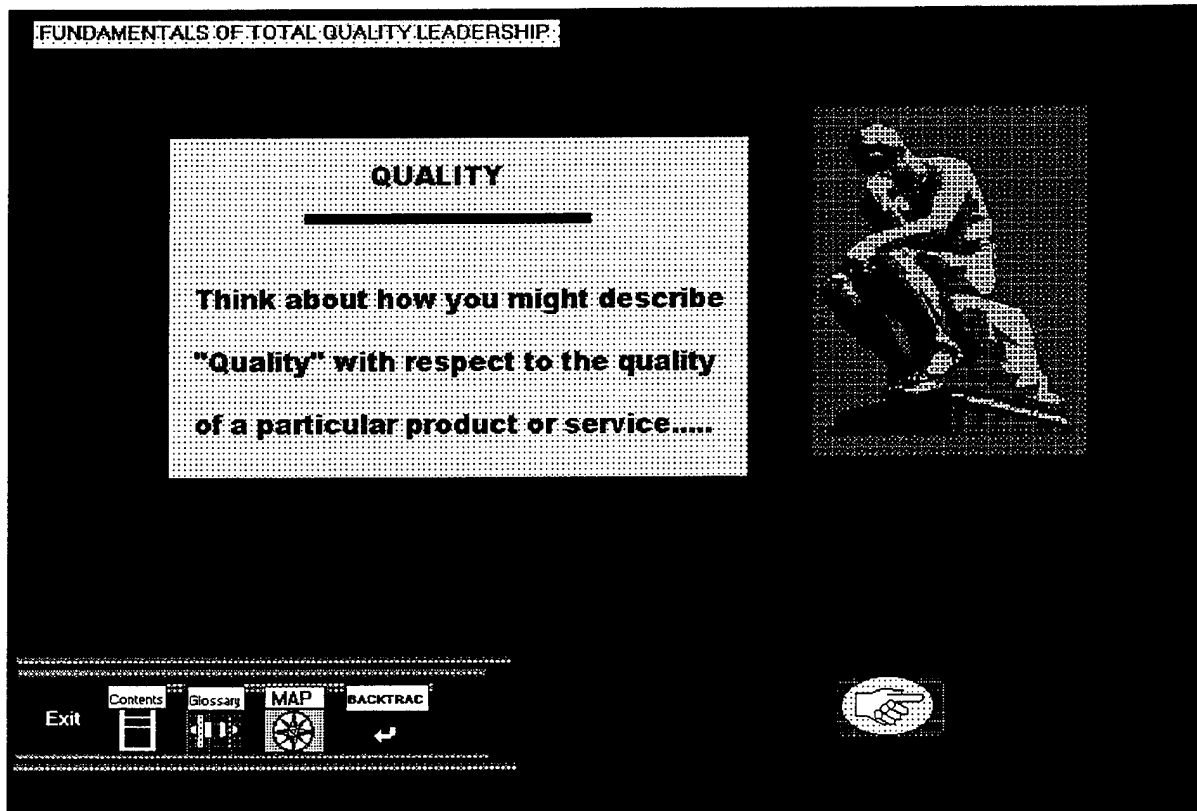


Figure 38 "Think About Quality" [storyboard p. 5]

"Continue" to "Cars" [storyboard p. 6]

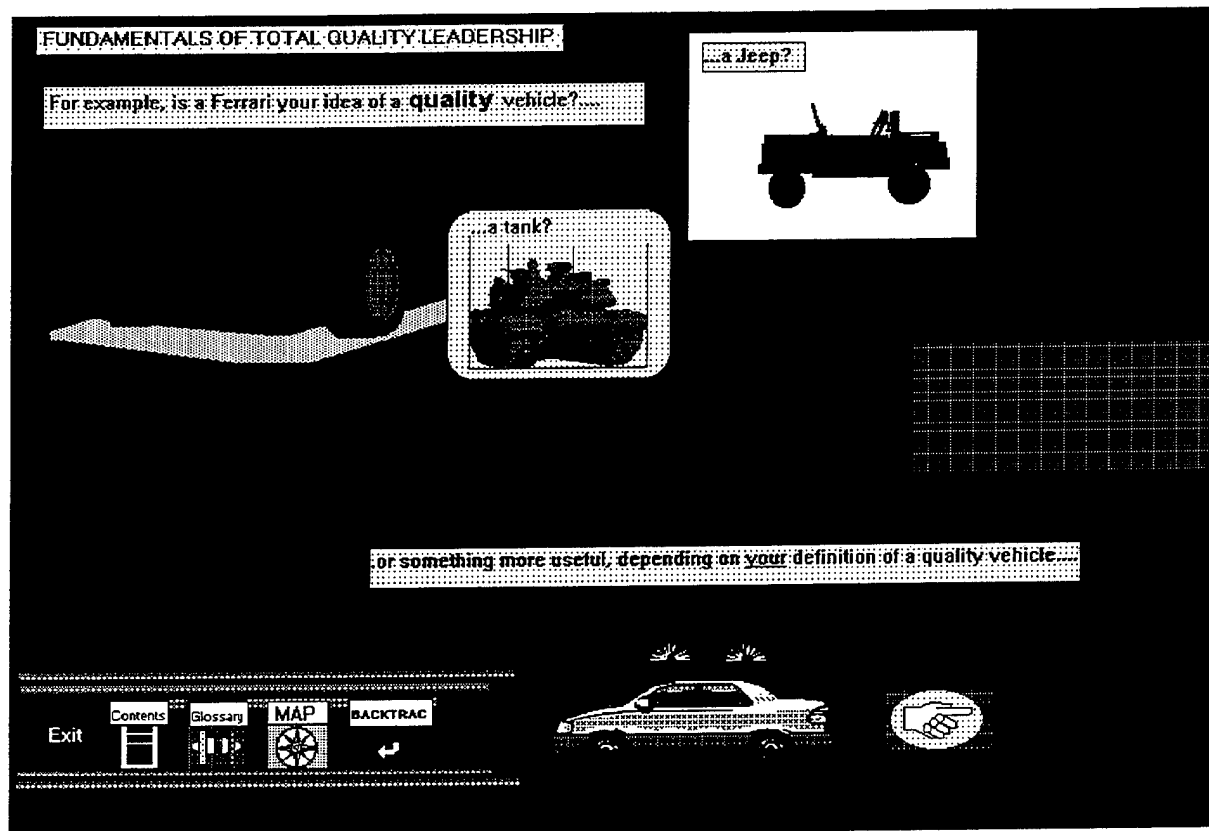


Figure 39 "Cars" [storyboard p. 6]

This toolbook page contains automation (tank & car moving across page)

"Continue" to "Wines" [storyboard p. 7]

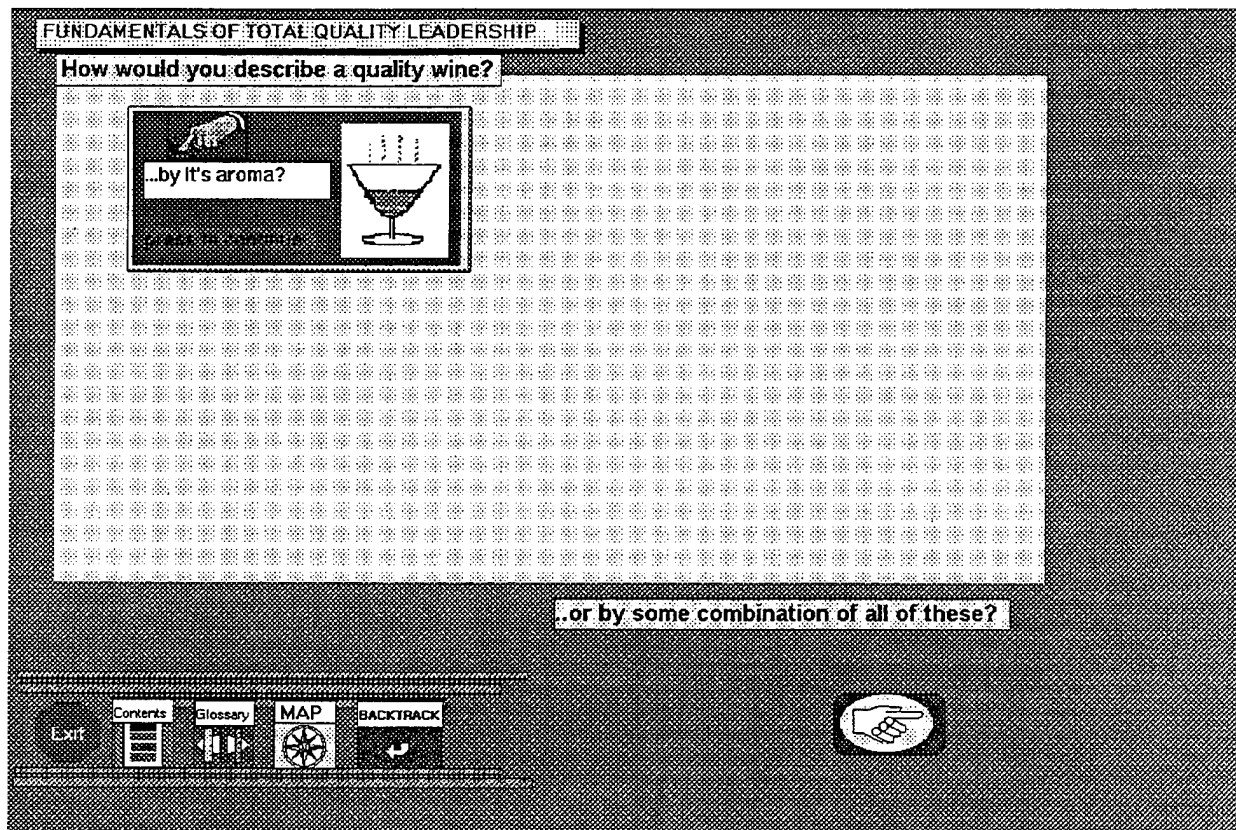


Figure 40 "Wines" [storyboard p. 7] [Step 1 of 5]

This toolbox page contains interaction, requiring student to press a block to "show" a second block....until all 5 blocks are displayed.

"Continue" to "Wines" [storyboard p. 7] [Step 2 of 5]

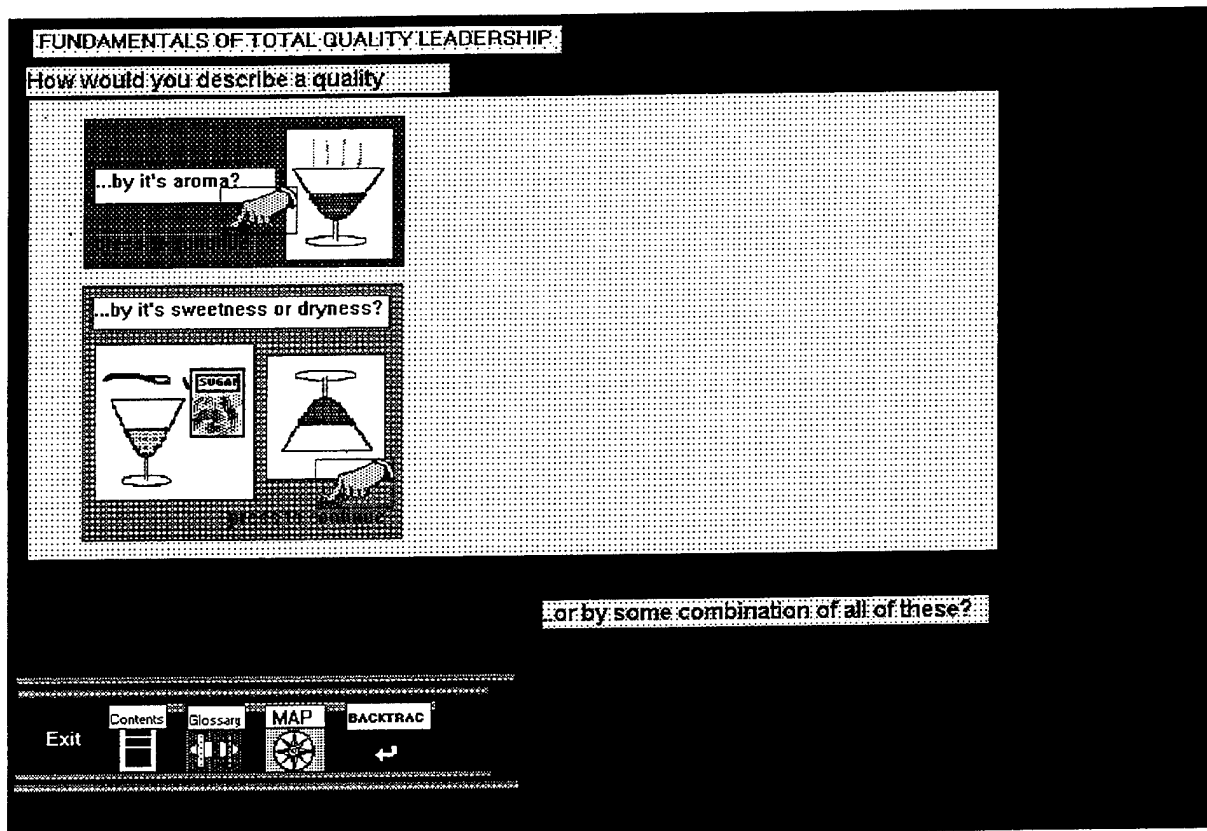


Figure 41 "Wines" [storyboard p. 7] [Step 2 of 5]

"Continue" to "Wines" [storyboard p. 7] [Step 3 of 5]

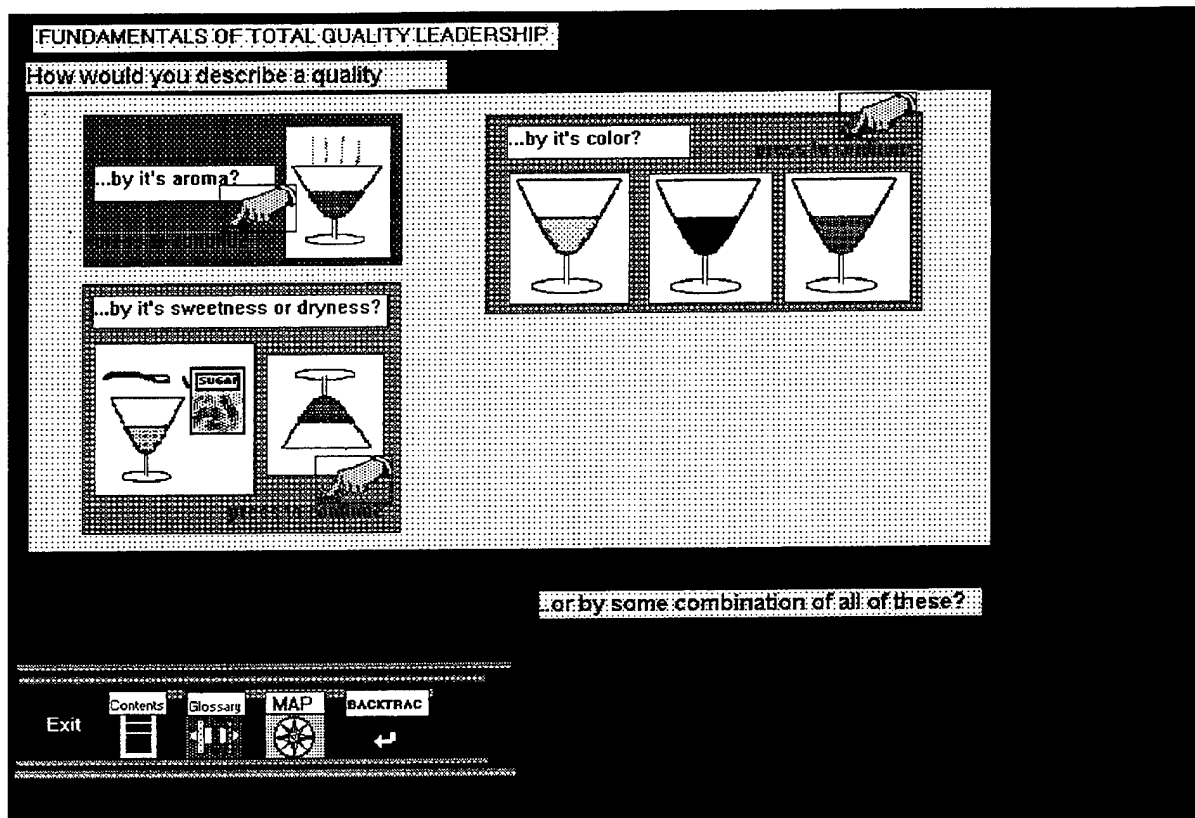


Figure 42 "Wines" [storyboard p. 7] [Step 3 of 5]

"Continue" to "Wines" [storyboard p. 7] [Step 4 of 5]

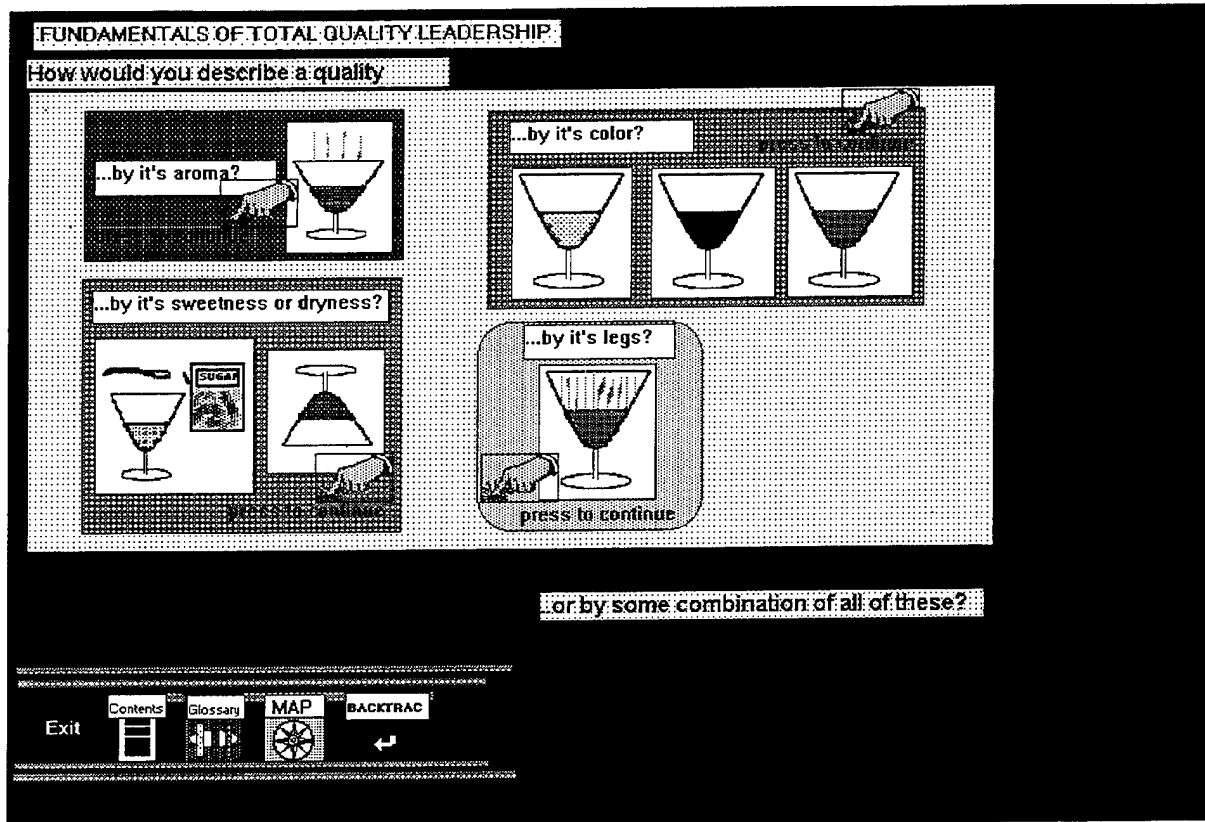


Figure 43 "Wines" [storyboard p. 7] [Step 4 of 5]

"Continue" to "Wines" [storyboard p. 7] [Step 5 of 5]

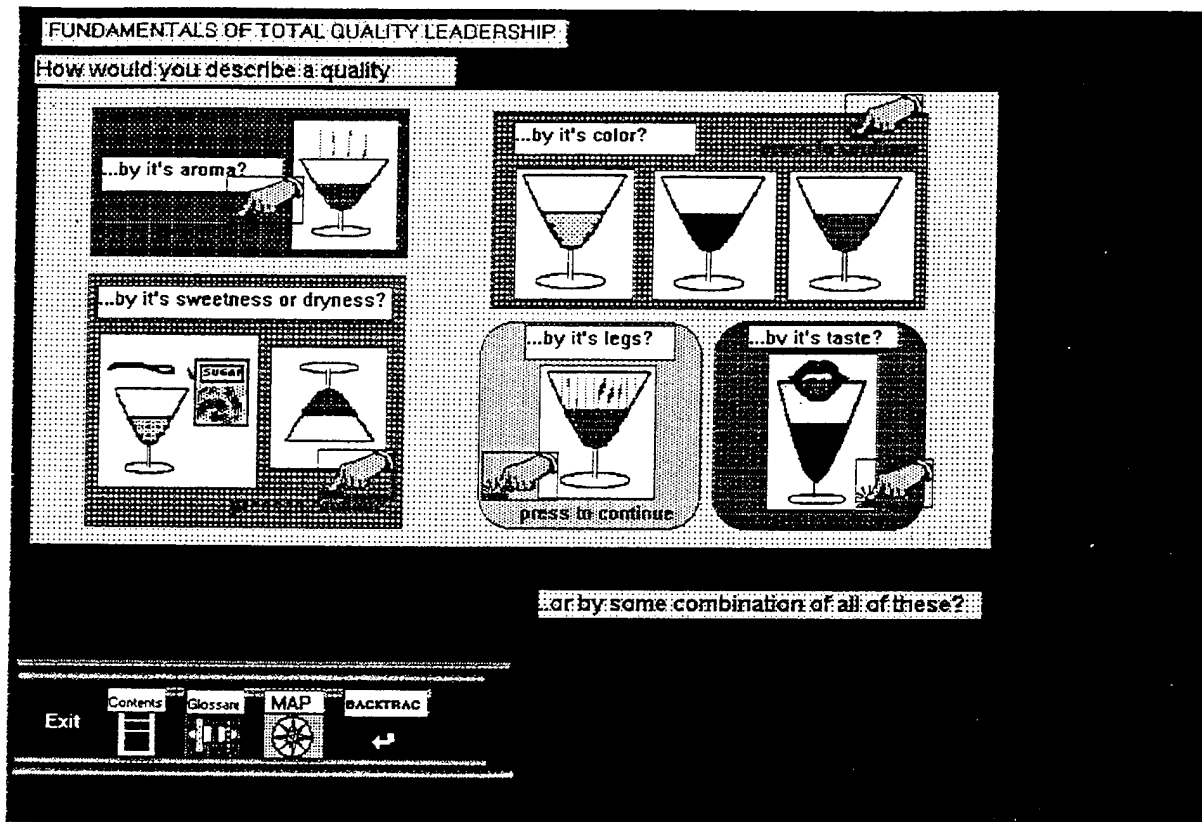


Figure 44 "Wines" [storyboard p. 7] [Step 5 of 5]

"Continue" to "What is Quality?" [storyboard p. 8]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

What is Quality?

A quality car.....jeep.....wine.....preparing for inspection.....or performing your daily duties...

How would **YOU** describe "quality"?

Type up to three words/phrases and <Enter> to describe what quality means to you?

1.

2.

3.

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Figure 45 "What is Quality?" [storyboard p. 8]

This toolbook page contains interaction, requiring the student to enter three descriptive terms/phrases for quality.
"Continue" to "Definitions" [storyboard p. 9]

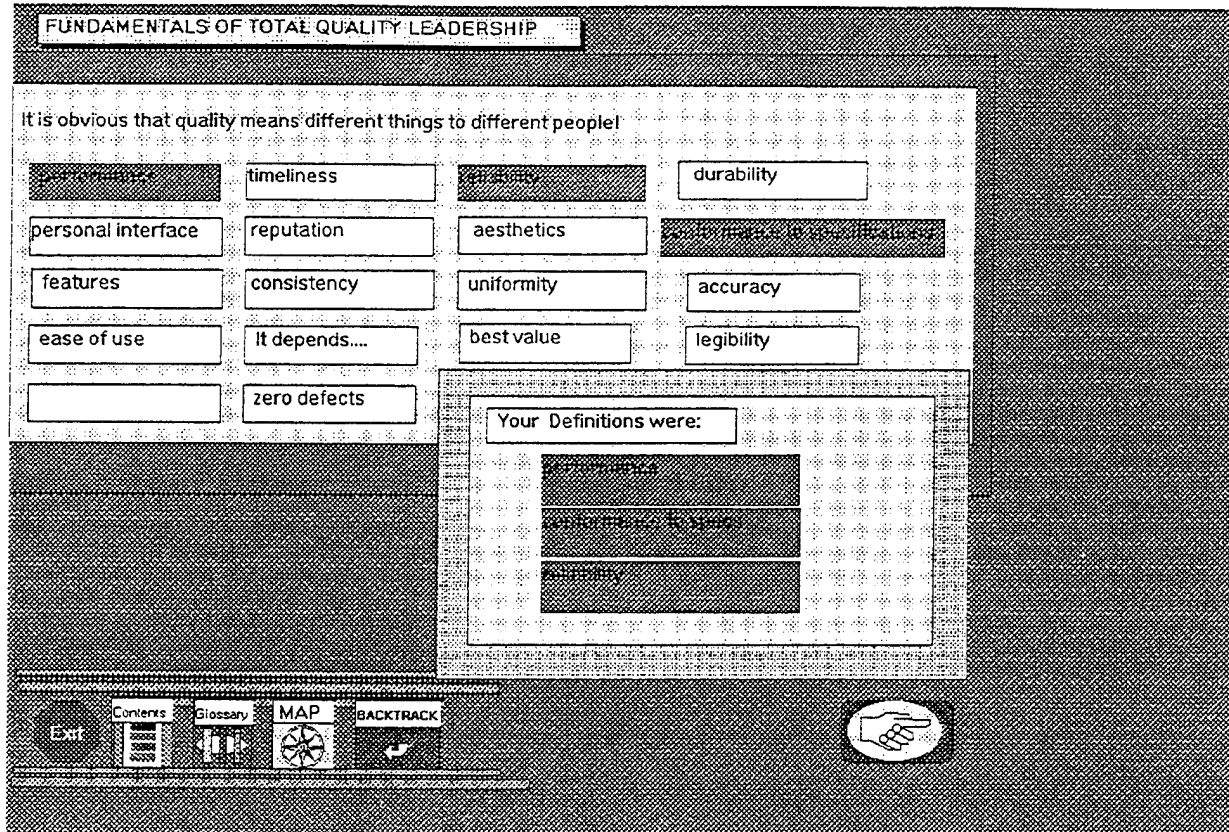


Figure 46 "Definitions" [storyboard p. 9]

This toolbook page reflects the student's entries made on the previous page, displays some popular characteristics of quality, and "matches" the list of characteristics with the student's entries, reflecting different colored matched pairs.

"Continue" to "Defining Quality" [storyboard p. 10]

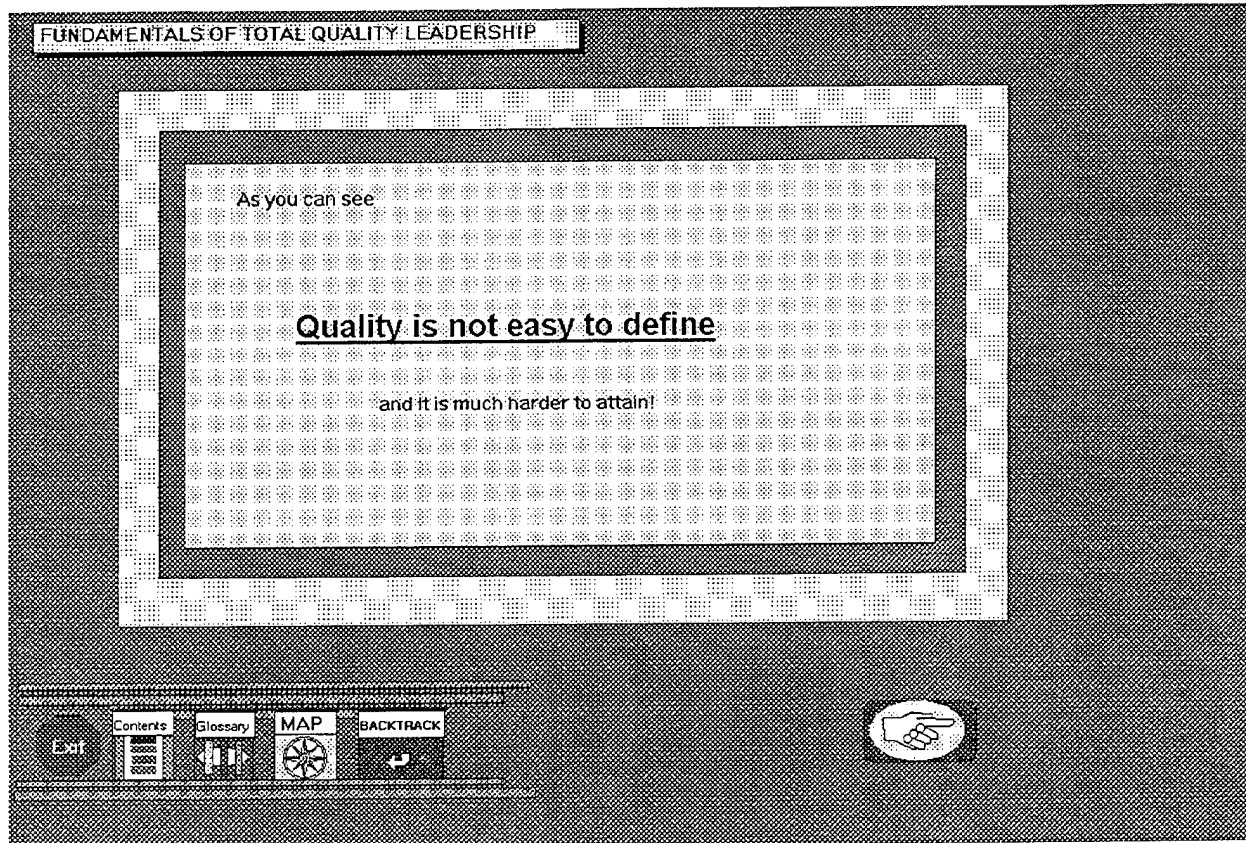


Figure 47 "Defining Quality" [storyboard p. 10]

"Continue" to "What its used for" [storyboard p. 11]

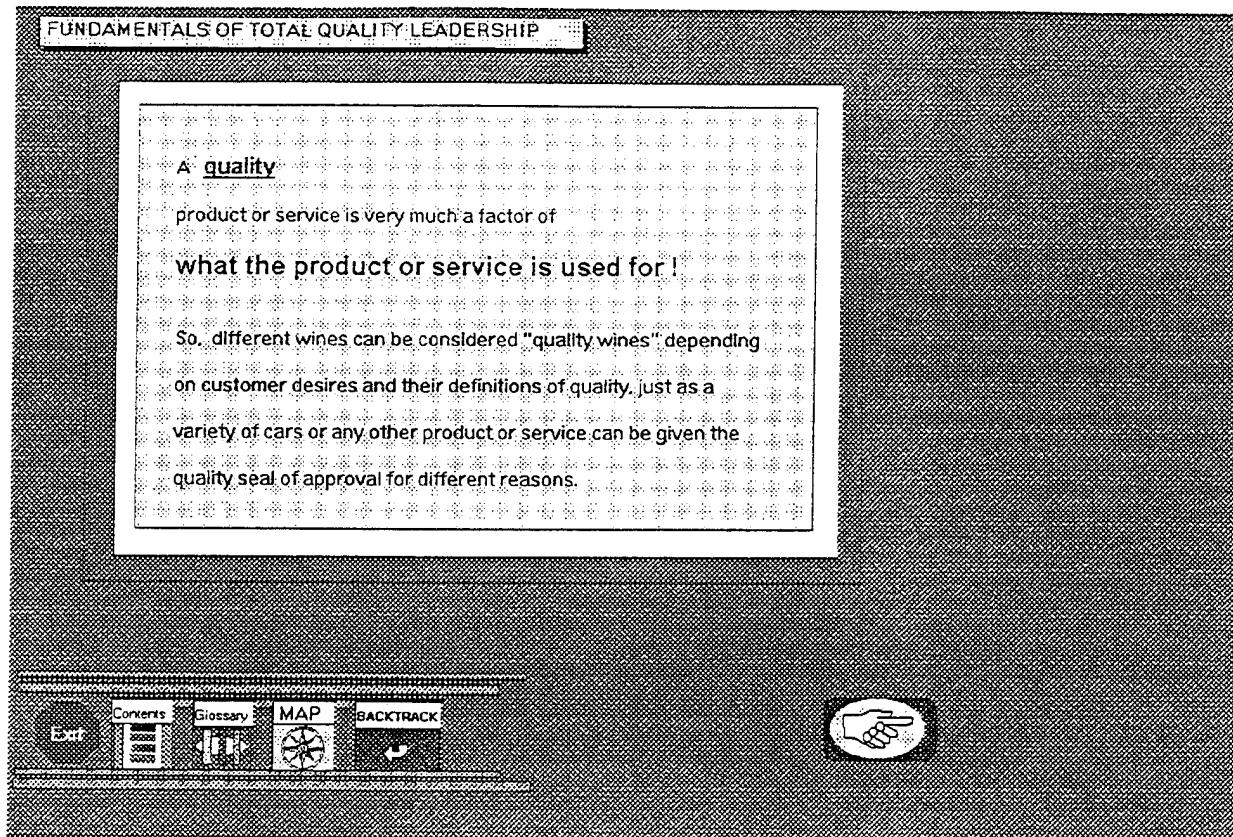


Figure 48 "What it's Used For" [storyboard p. 11]

"Continue" to "What is a Customer?" [storyboard p. 14]

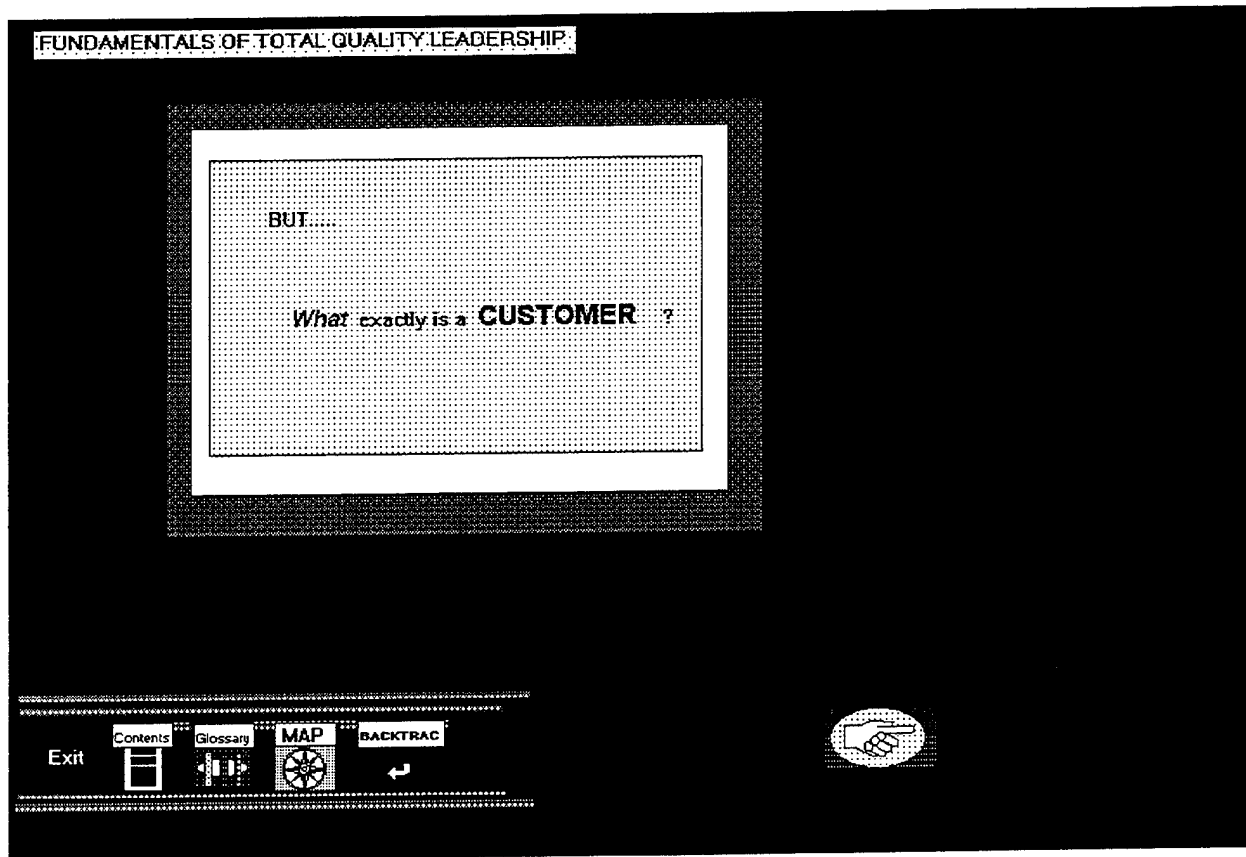


Figure 49 "What is a Customer?" [storyboard p. 14]

"Continue" to "A Customer is" [storyboard p. 15]

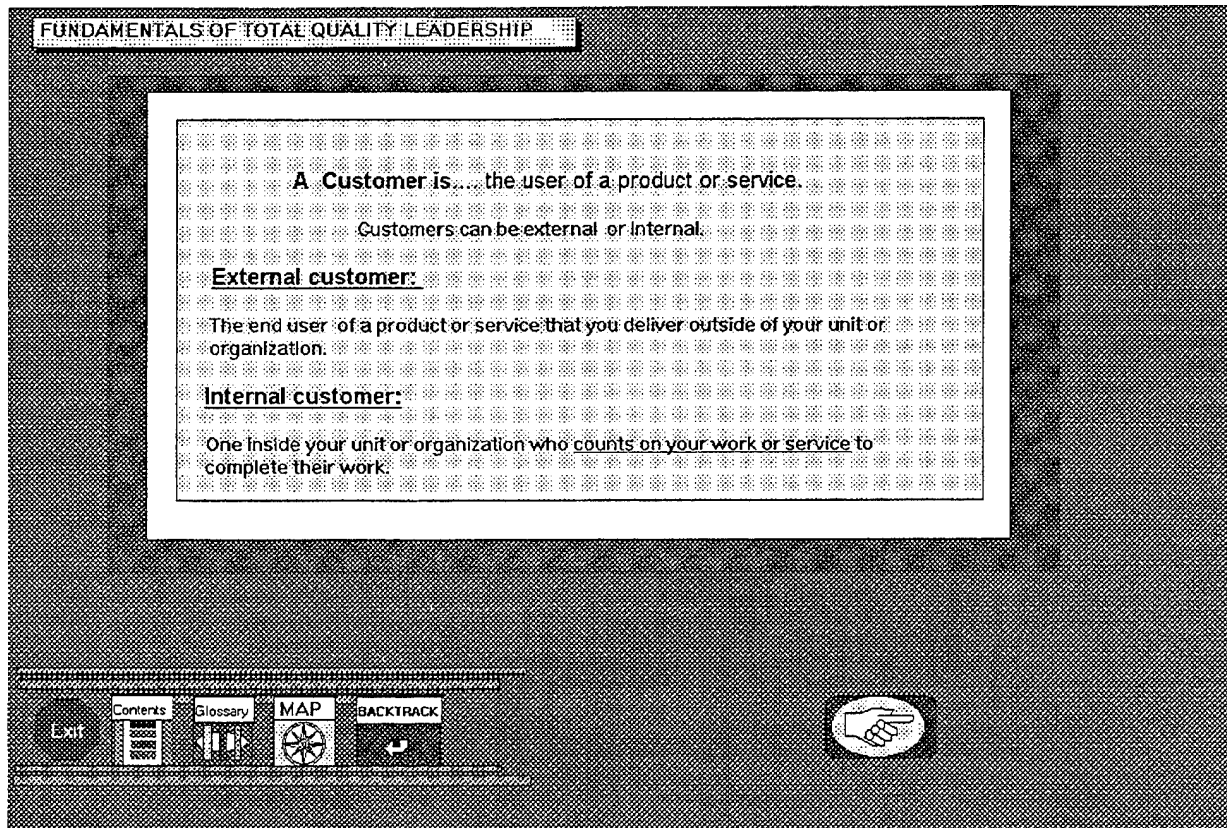


Figure 50 "A Customer is" [storyboard p. 15]

"Continue" to "Your-Product" [storyboard p. 16]

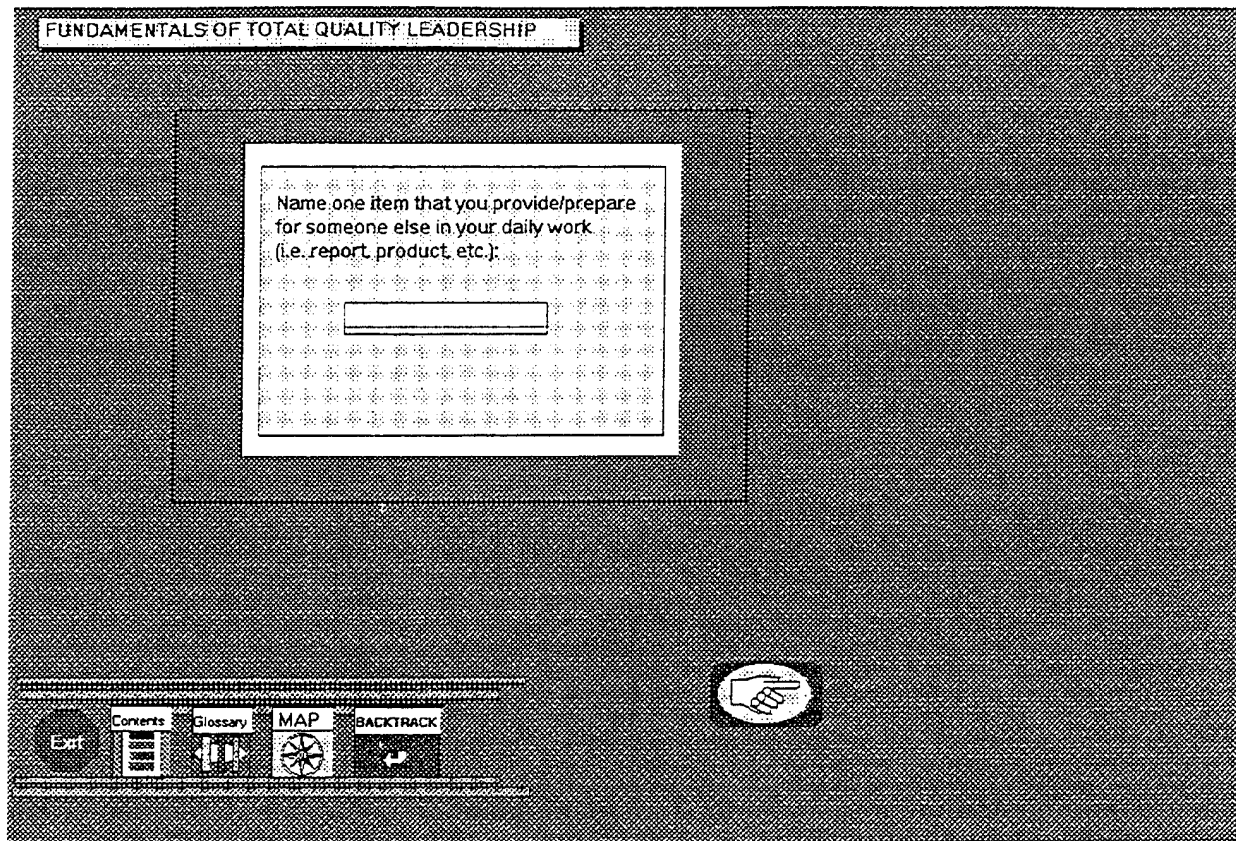


Figure 51 "Your-Product" [storyboard p. 16]

This toolbook page requires interaction by the student to enter a product/service
"Continue" to "Supplier" [storyboard p. 17]

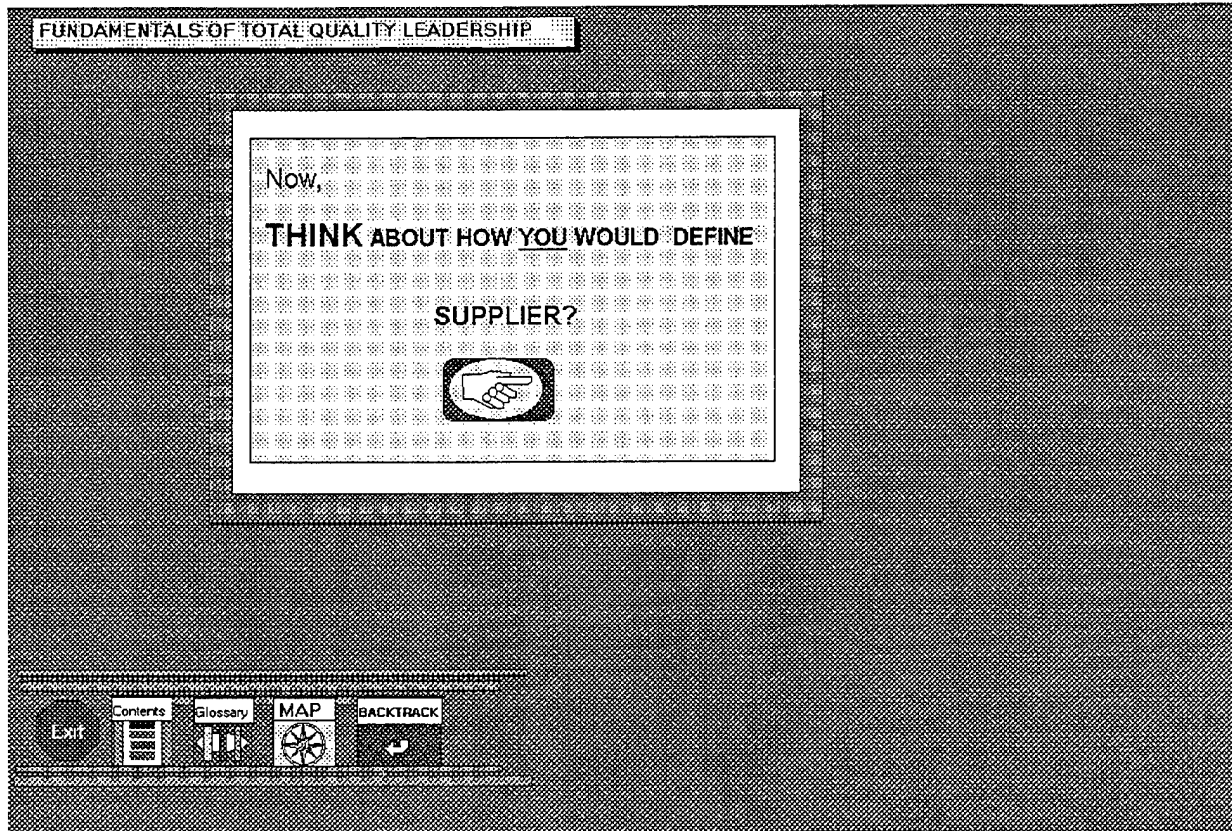


Figure 52 "Supplier" [storyboard p. 17] [Step 1 of 3]

"Continue" to "Supplier" [storyboard p. 17] [Step 2 of 3]

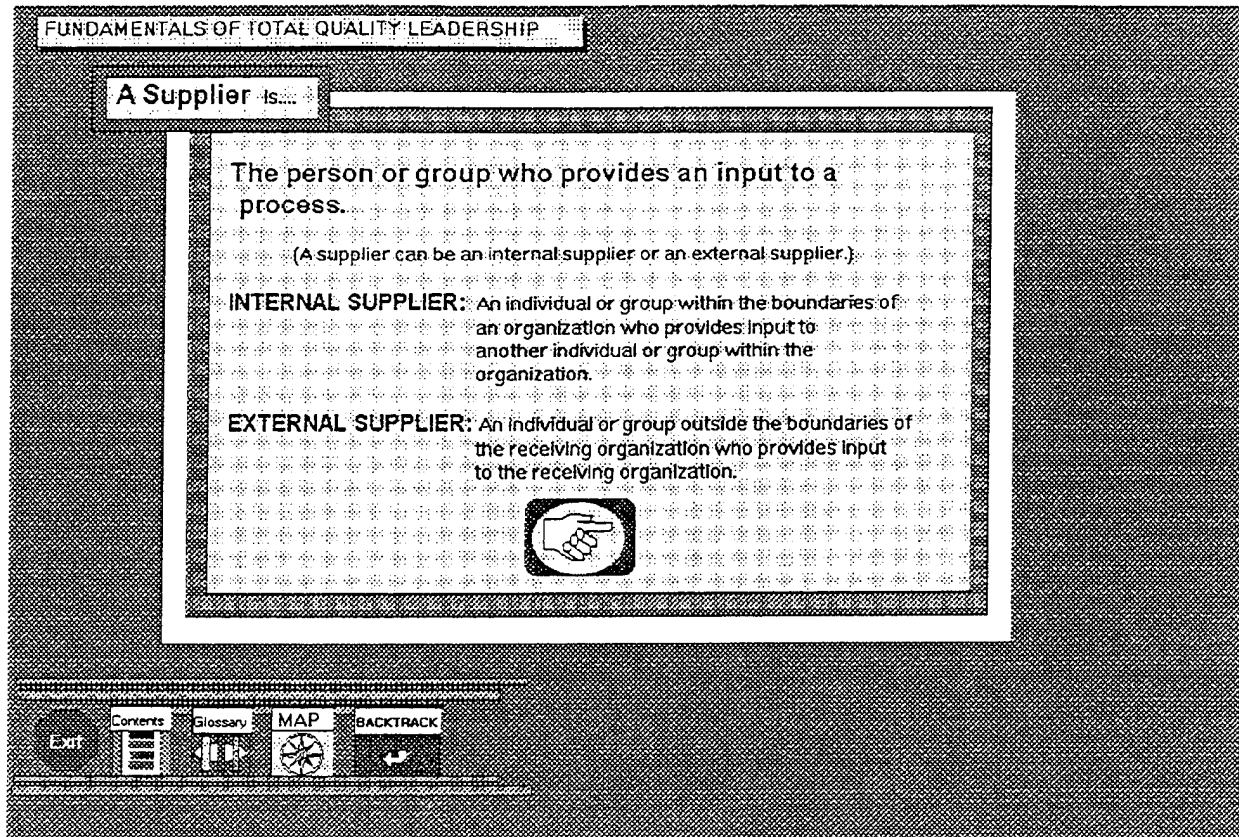


Figure 53 "Supplier" [storyboard p. 17] [Step 2 of 3]

"Continue" to "Supplier" [storyboard p. 17] [Step 3 of 3]

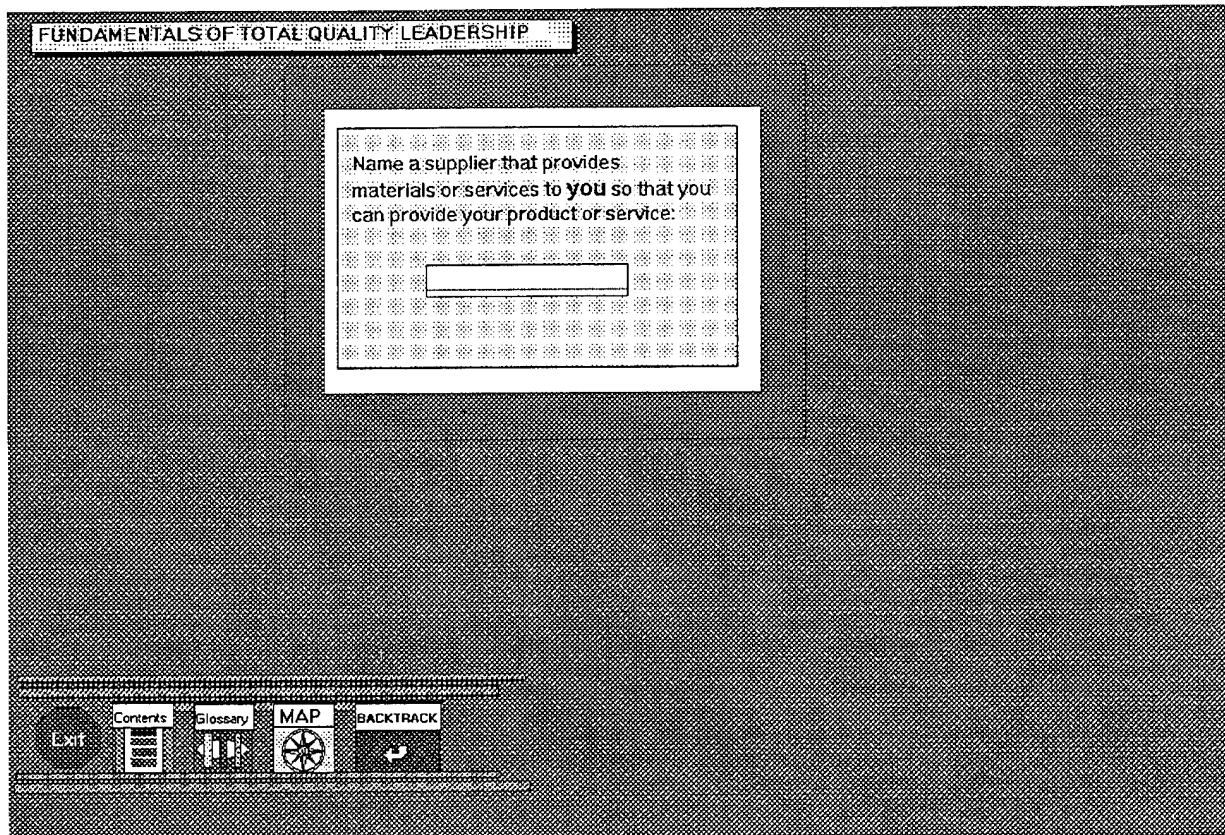


Figure 54 "Supplier" [storyboard p. 17] [Step 3 of 3]

This toolbox page requires interaction by the student to enter a supplier of his/her product/service
"Continue" to "Product-Customer" [storyboard p. 18]

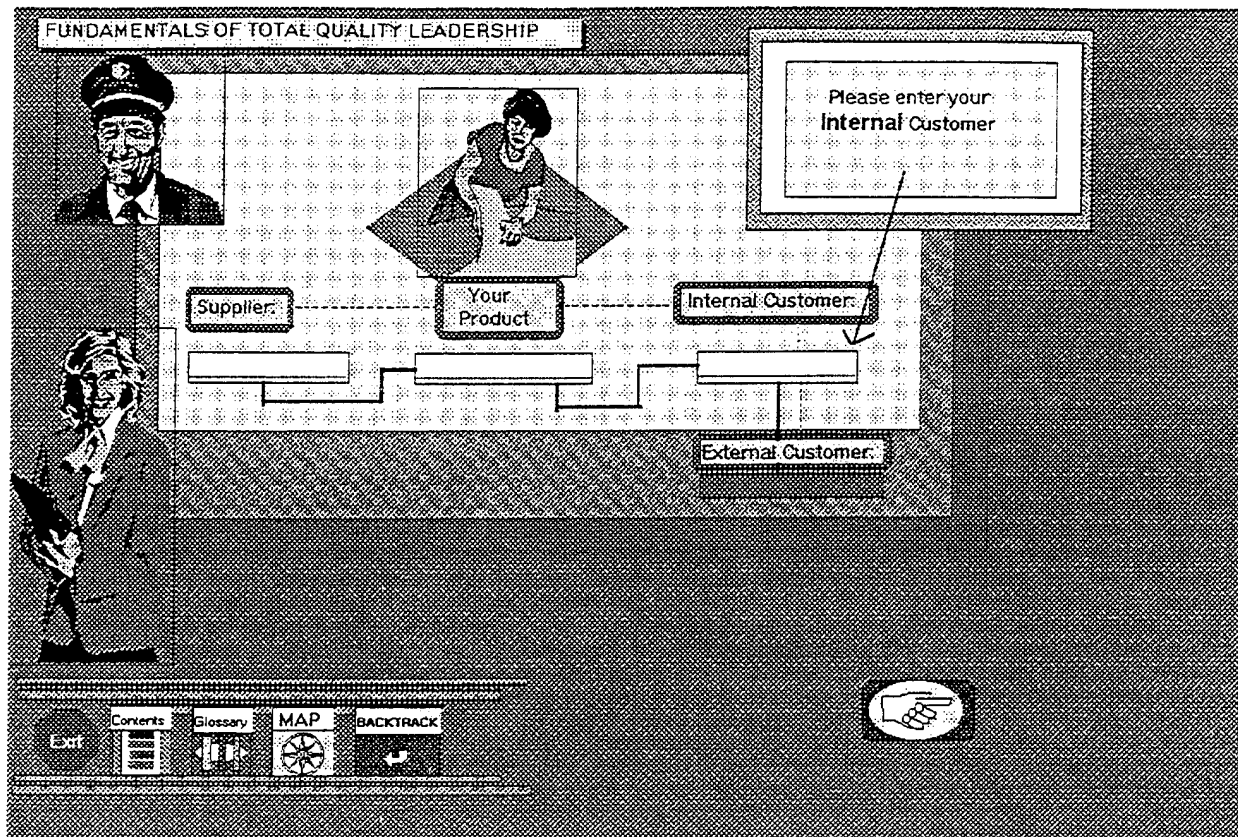


Figure 55 "Product-Customer" [storyboard p. 18] [Step 1 of 2]

This toolbox page reflects the student's entries on the previous two pages, displaying the product/service and supplier entered

This page also requires the student to enter an internal customer for his/her product/service

"Continue" to "Product-Customer" [storyboard p. 18] [Step 2 of 2]

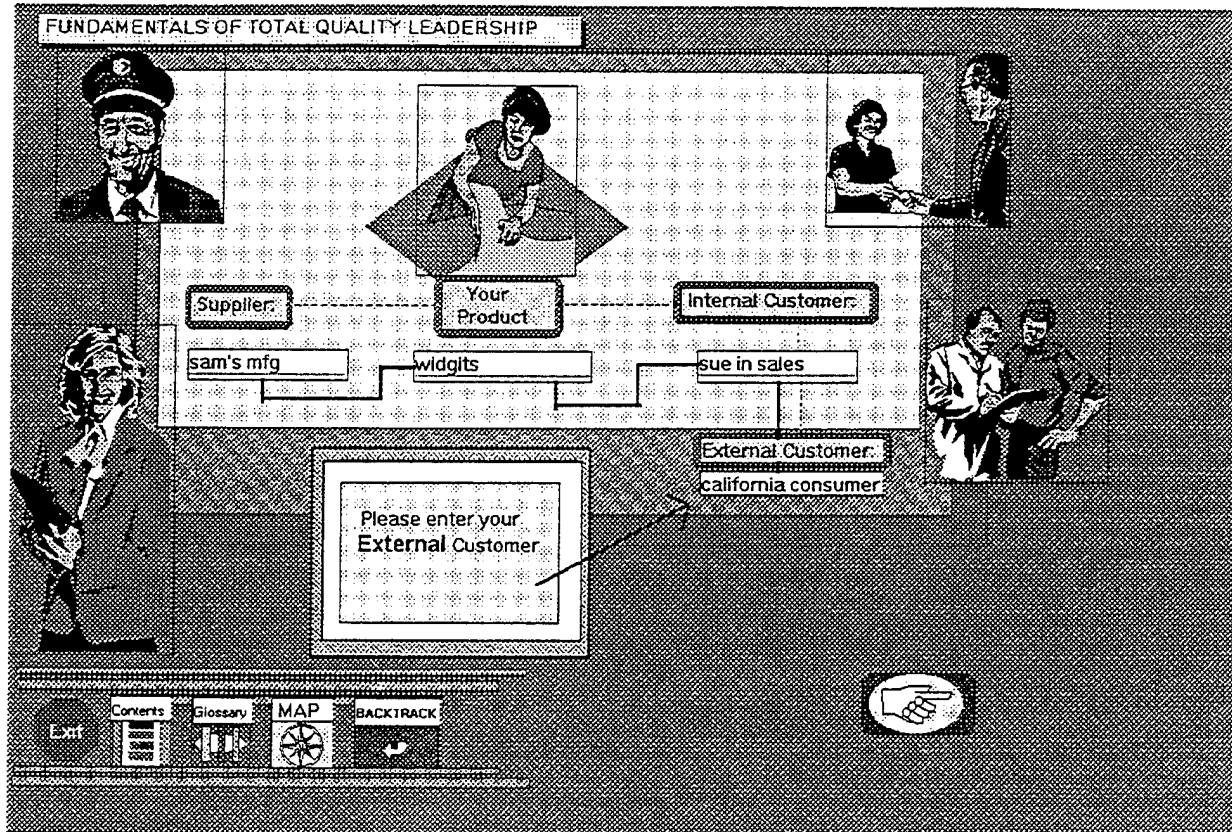


Figure 56 "Product-Customer" [storyboard p. 18] [Step 2 of 2]

This page requires the student to enter an external customer for his/her product/service reflecting the overall customer-supplier relationship that exists

"Continue" to "Meet and Exceed RQMTS" [storyboard p. 19]

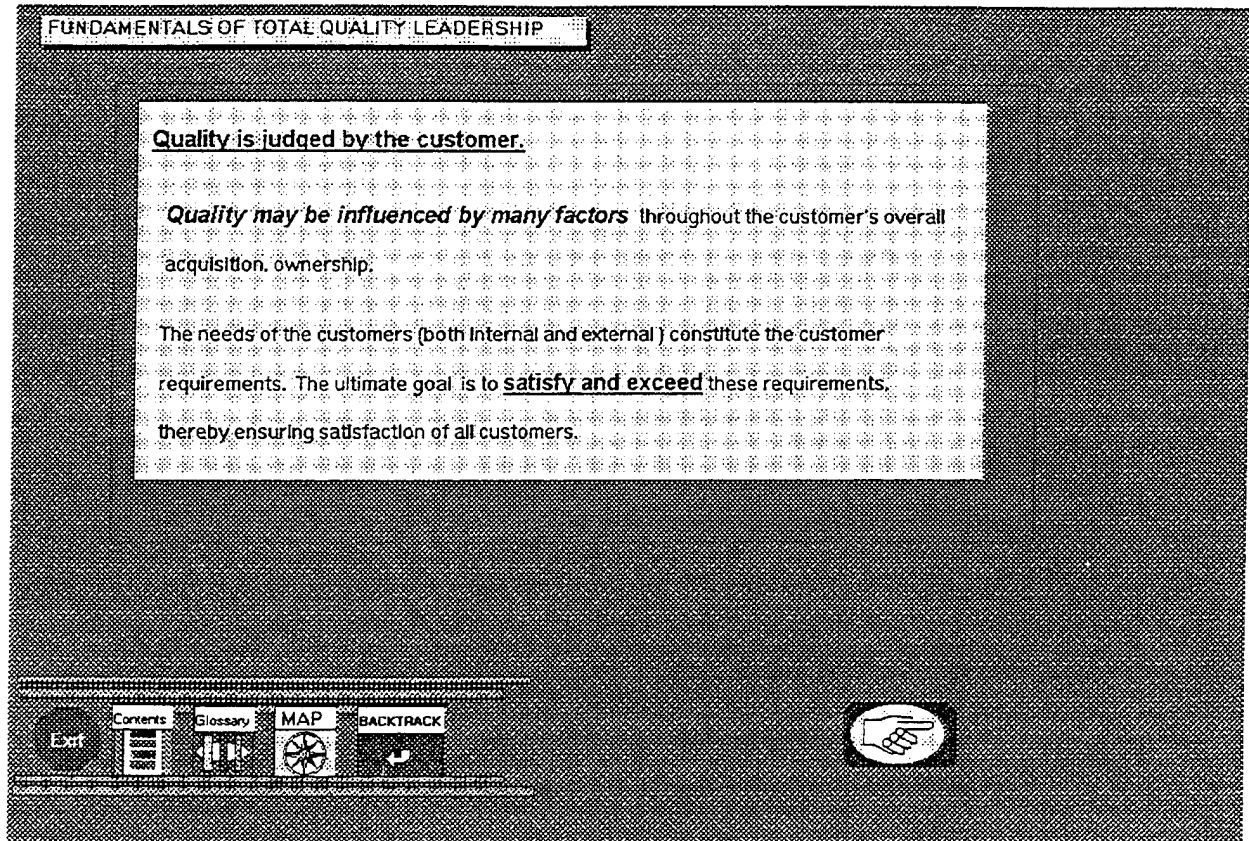


Figure 57 "Meet and Exceed RQMTS" [storyboard p. 19]

"Continue" to "Difficulty" [storyboard p. 20]

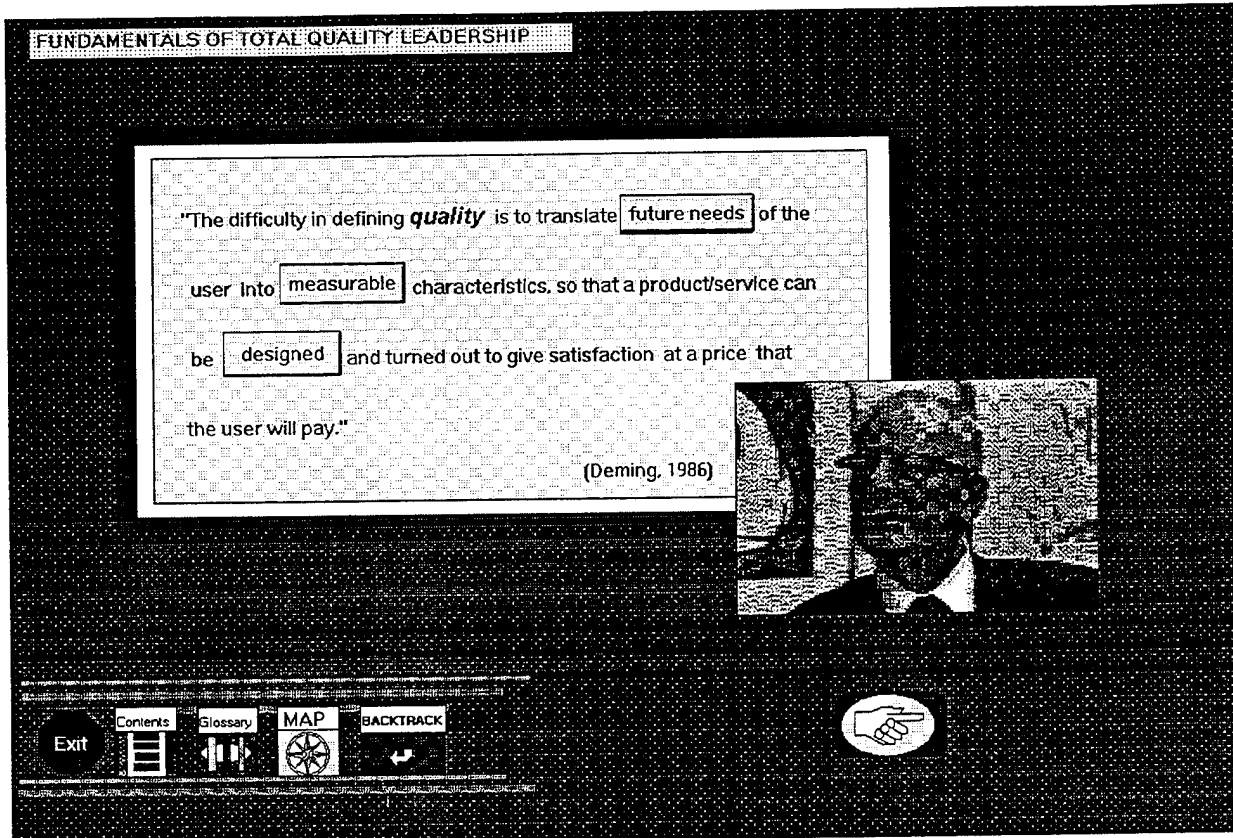


Figure 58 "Difficulty" [storyboard p. 20]

"Future needs" to "Future Needs" [storyboard p. 52]
"Measurable" to "Measurable" [storyboard p. 50]
"Designed" to "Designed" [storyboard p. 54]
"Continue" to "Customer Defines" [storyboard p. 13]

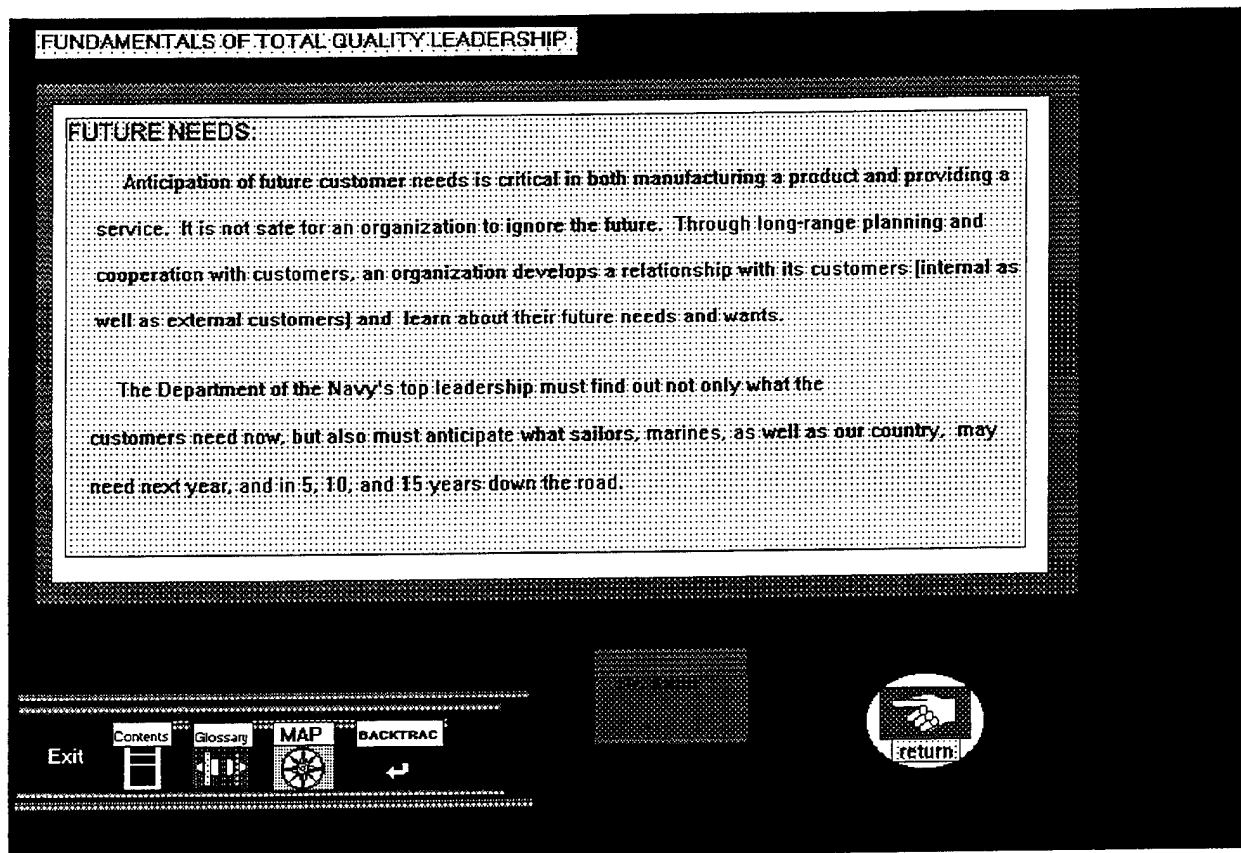


Figure 59 "Needs" [storyboard p. 52]

"Kano" to "Kano" [storyboard p. 53] [optional]

"Return" to "Difficulty" [storyboard p. 20]

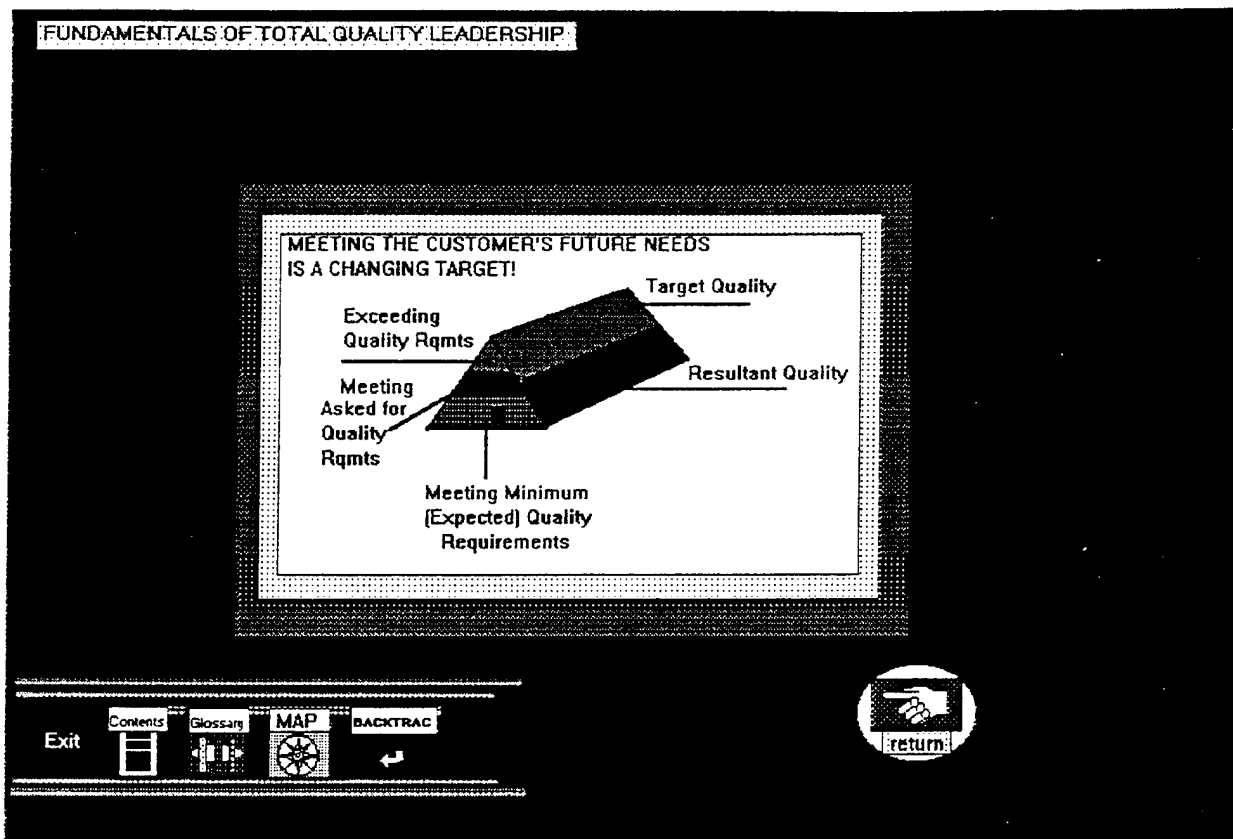


Figure 60 "Kano" [storyboard p. 53]

"Return" to "Needs" [storyboard p. 52]

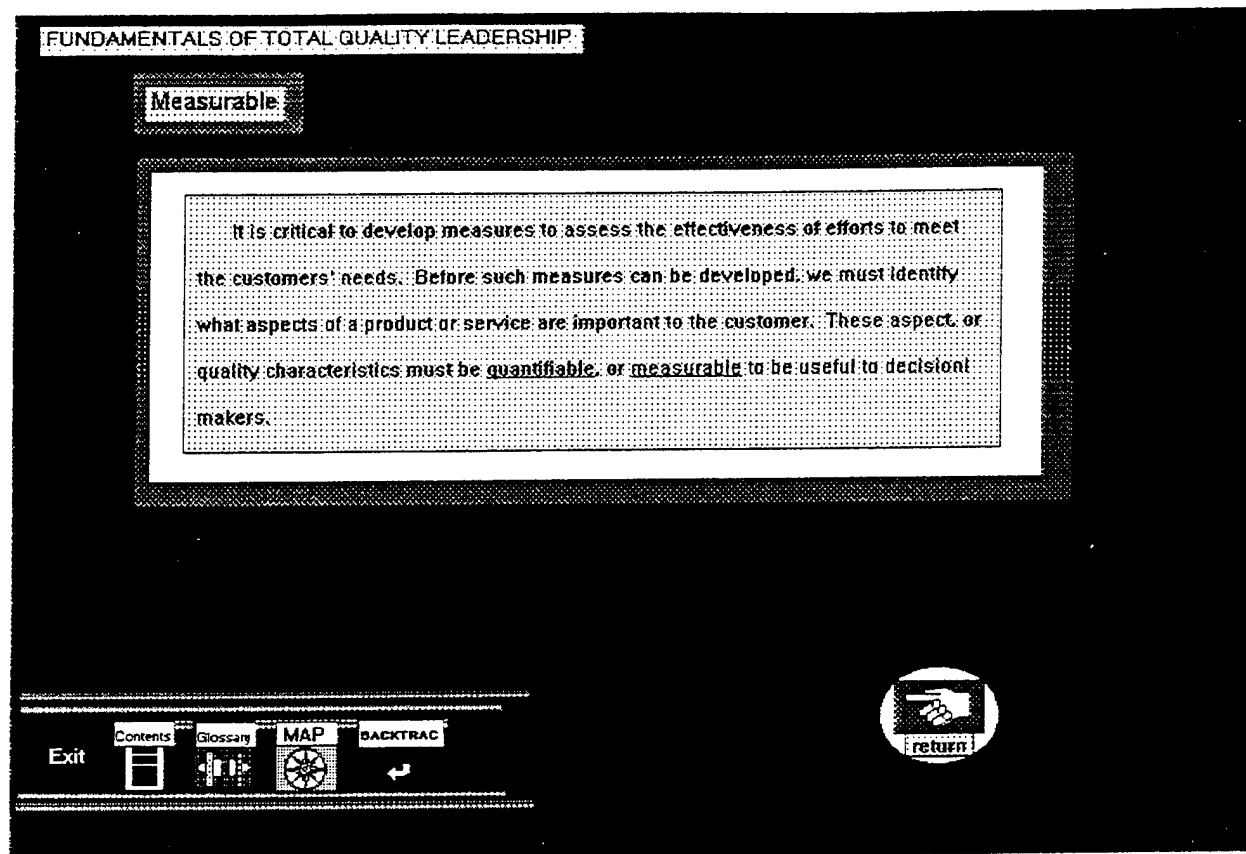


Figure 61 "Measurable" [storyboard p. 50]

"Return" to "Difficulty" [storyboard p. 20]

DESIGNED:

Quality by design is a very important engineering concept, since a design is very expensive to change once it has been set. For this reason, customer information is actively sought and incorporated into the original design of the product or service.

Quality function deployment is a structured method in which customer requirements are considered throughout product development and production.

By designing quality into the product or service, **customer satisfaction** is more easily achieved.



Exit



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Figure 62 "Designed" [storyboard p. 54]

"Quality Function Deployment" to "QFD" [storyboard p. 66]

"Customer Satisfaction" to "Satisfaction" [storyboard p. 55]

"Return" to "Difficulty" [storyboard p. 20]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

QFD is a system for designing product or service based on customer demands and involving all members of the producer or supplier organization. It is sometimes referred to as the most advanced form of Total Quality Control, Japanese style, which can be described by the following chart:

| | | |
|-----------------|--------------|--------------------|
| All employees | Improving or | To give customers |
| All departments | maintaining | product or service |
| | quality | that is |
| | cost | best qualified |
| | yield | most useful |
| | procedures | most economic |
| | systems | |

What QFD does is add design to the improvement and maintenance activities of all employees to give customers the best product. QFD can be narrowly defined as the organization that makes the design improvement effort possible. Broadly defined, QFD also includes the charts that document the design process.



Exit



Figure 63 "QFD" [storyboard p. 66] [Step 1 of 2]

"Continue" to "QFD" [storyboard p. 66] [Step 2 of 2]

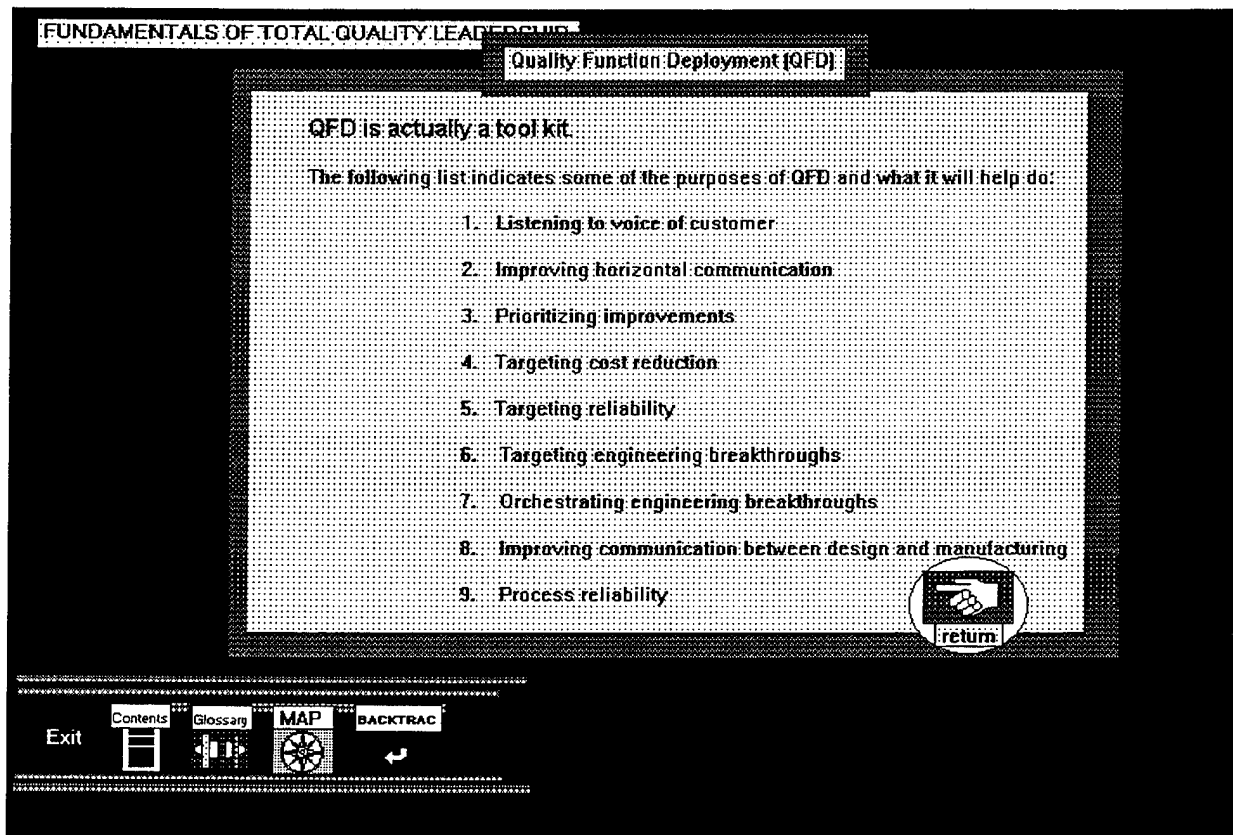


Figure 64 "QFD" [storyboard p. 66] [Step 2 of 2]

"Return" to "Designed" [storyboard p. 54]

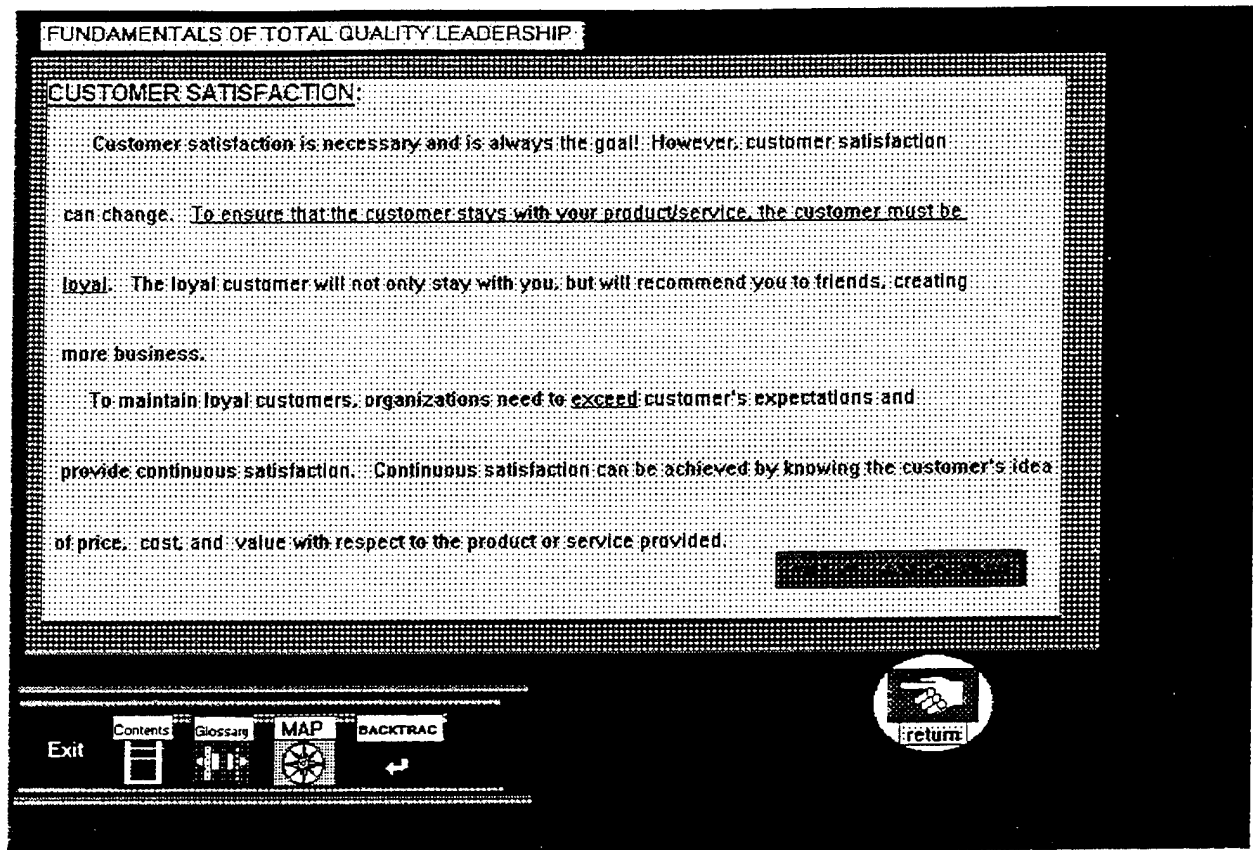


Figure 65 "Satisfaction" [storyboard p. 55]

"Price vs. Cost vs. Value" to "Cost vs. Value" [storyboard p. 56] [optional]

"Return" to "Designed" [storyboard p. 54]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

PRICE vs. VALUE:

Price is not the same as cost. Price is what the customer will pay for a product or service.

Cost is

- 1) development/production costs for the supplier
- 2) life-cycle costs for the customer.

Accepting the lowest price may not give the customer the best value when life-cycle costs are considered (i.e. poor quality product).

Value can be defined in terms of quality. $\text{Value} = \text{Quality} / \text{Cost}$. But remember that value, like quality, has a different meaning to different customers.

Exit



Figure 66 "Cost vs. Value" [storyboard p. 56]

"Return" to "Satisfaction" [storyboard p. 55]

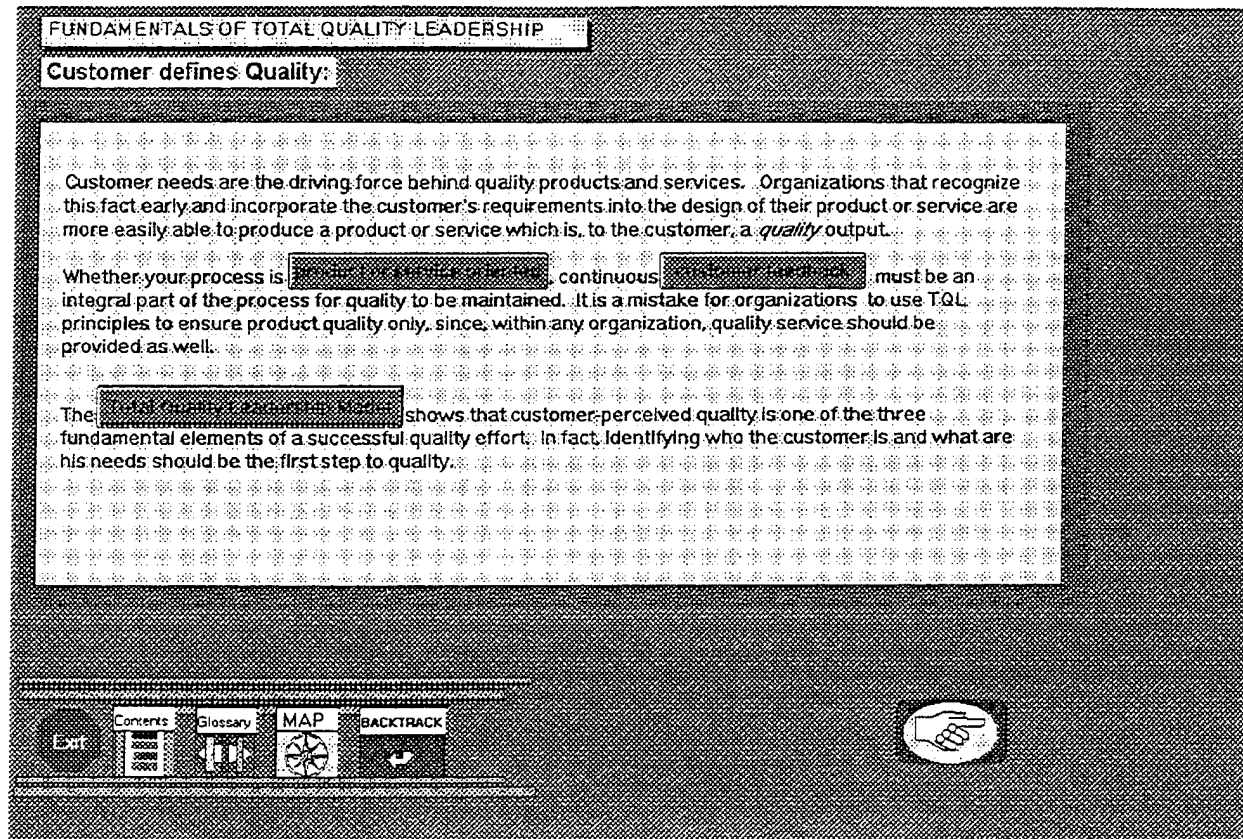


Figure 67 "Customer Defines" [storyboard p. 13]

"Product or Service Oriented" still under construction

"Customer Feedback" to "Customer Feedback" [storyboard p. 31] [optional]

"Total Quality Leadership Model" to "TQL Model" [storyboard p. 71]

"Continue" to "Quality Depends" [storyboard p. 12]

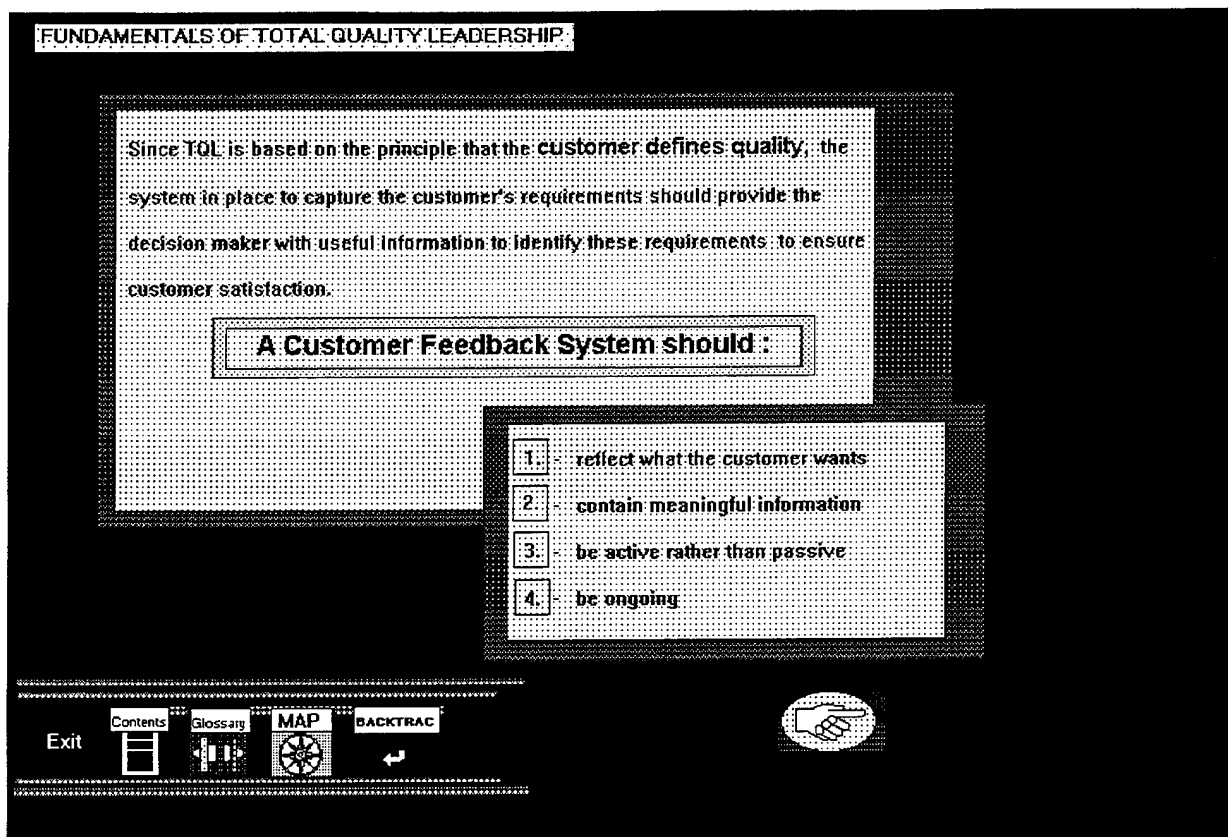


Figure 68 "Customer Feedback" [storyboard p. 31]

This page is also displayed later in the lesson [optional now; required later]
"Return" to "Customer Defines" [storyboard p. 13]

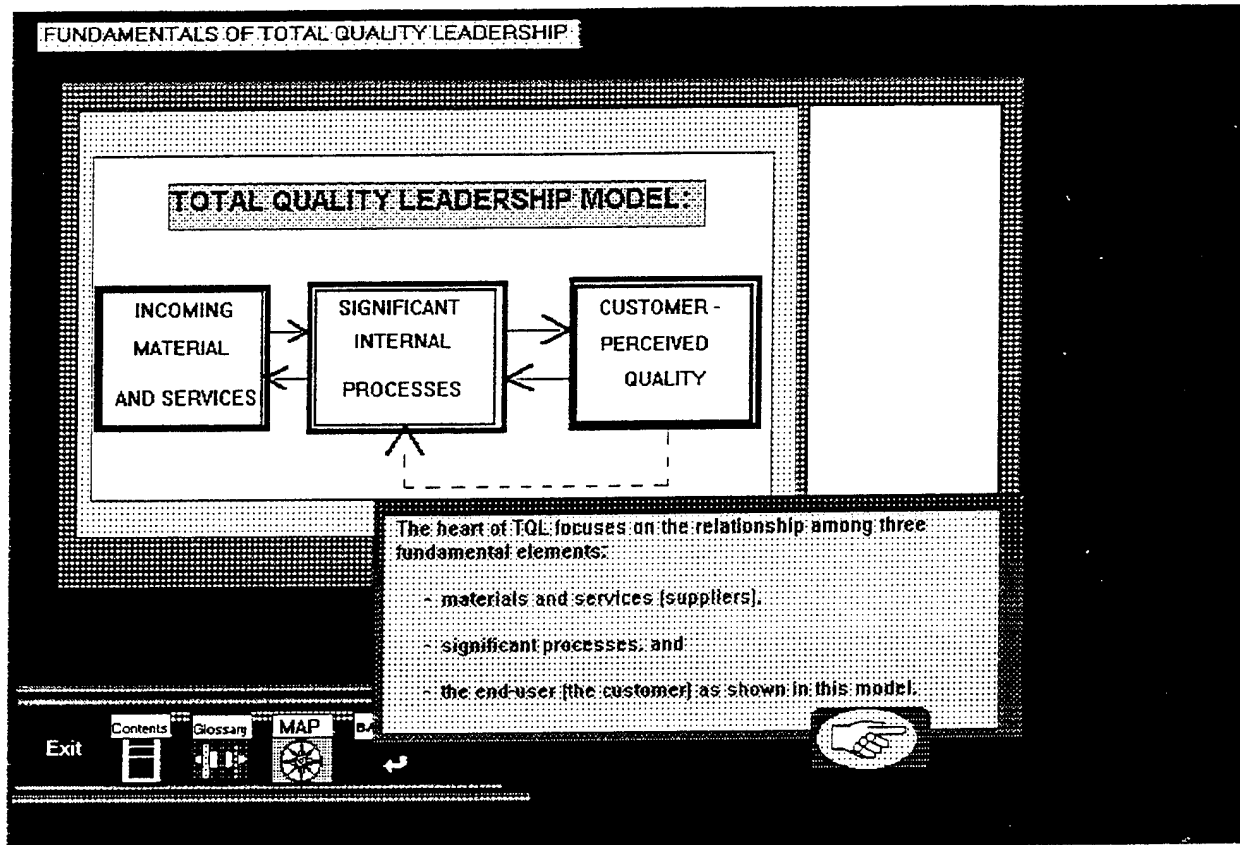


Figure 69 "TQL Model" [storyboard p. 71] [Step 1 of 4]

"Continue" to "TQL Model" [storyboard p. 71] [Step 2 of 4]

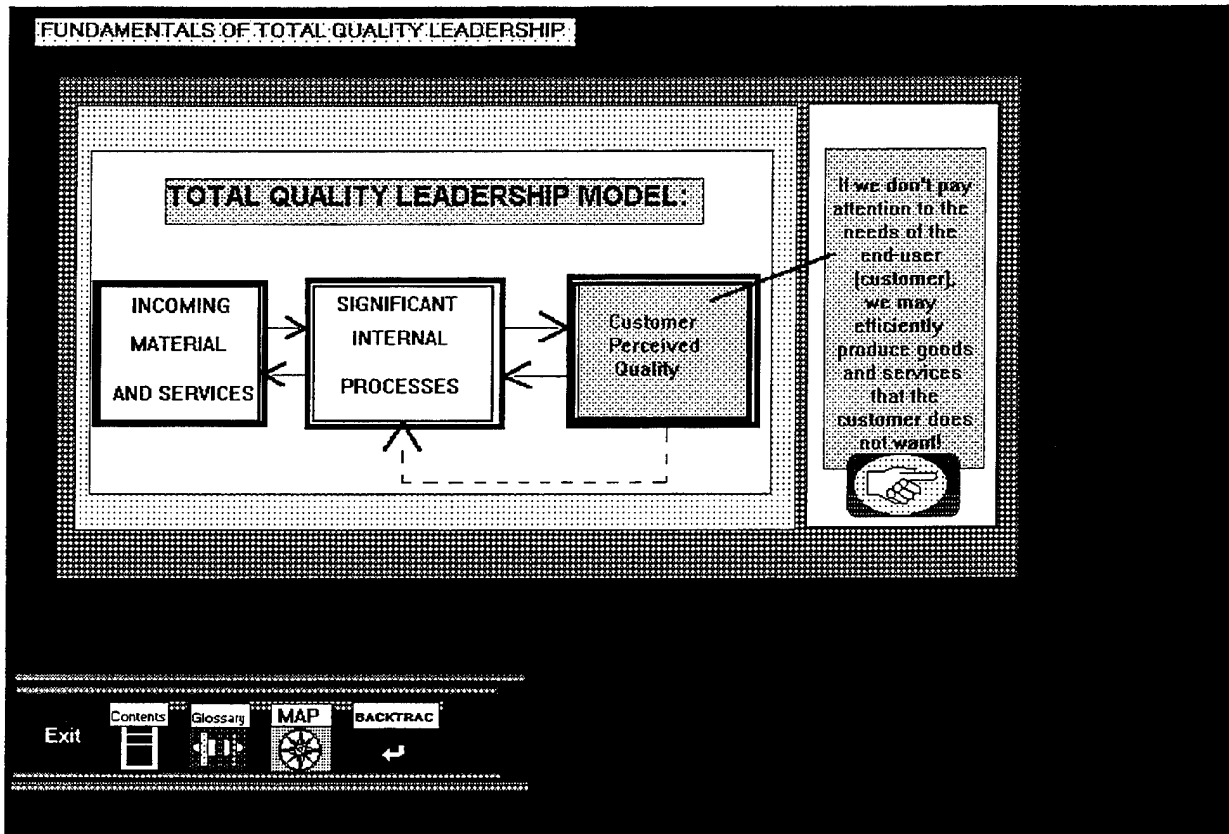


Figure 70 "TQL Model" [storyboard p. 71] [Step 2 of 4]

"Continue" to "TQL Model" [storyboard p. 71] [Step 3 of 4]

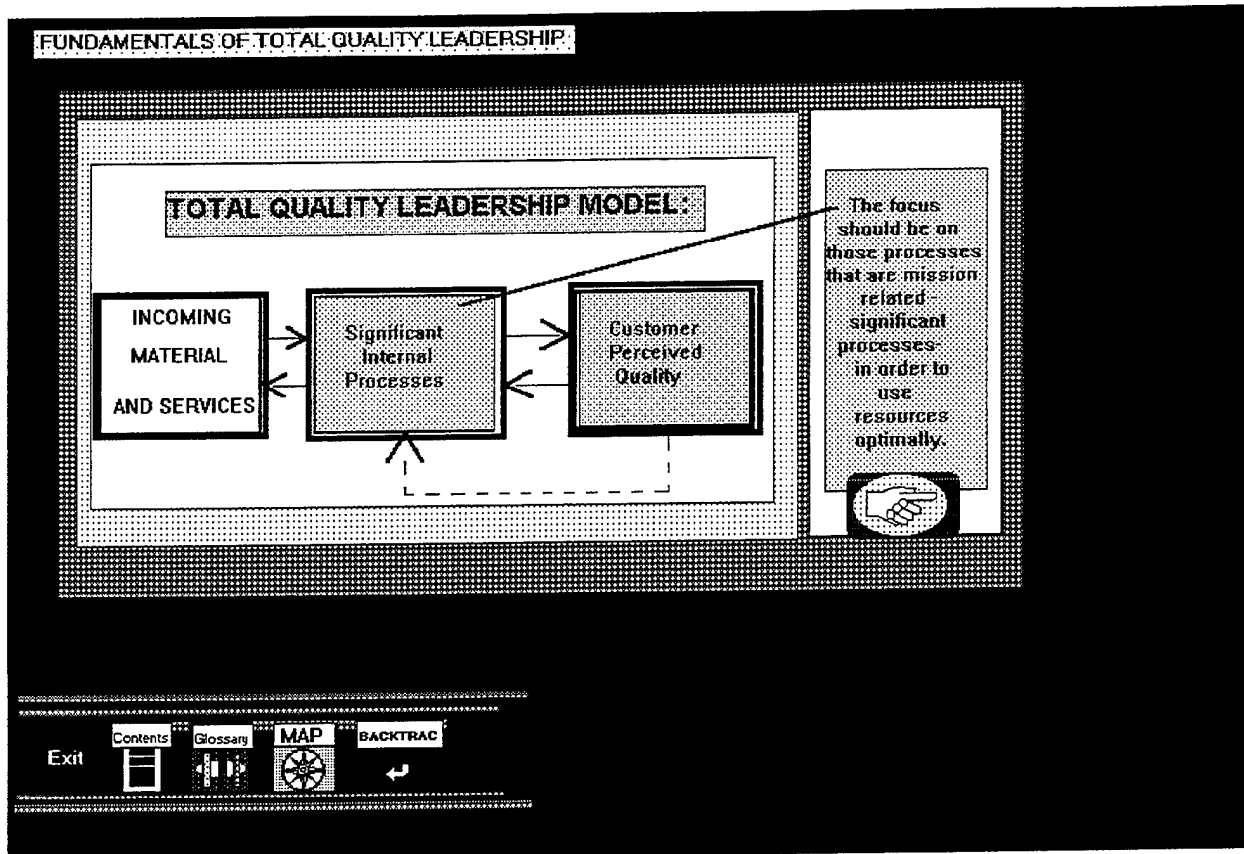


Figure 71 "TQL Model" [storyboard p. 71] [Step 3 of 4]

"Continue" to "TQL Model" [storyboard p. 71] [Step 4 of 4]

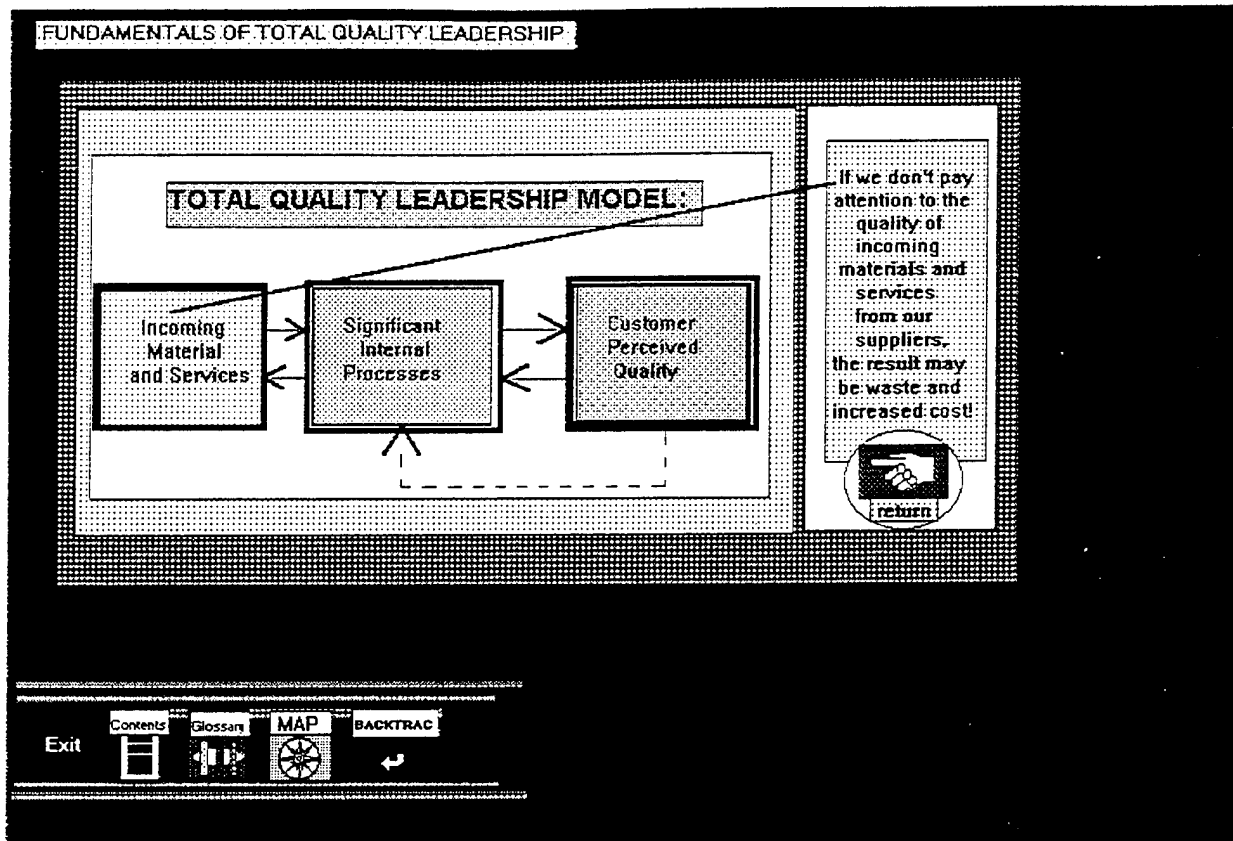


Figure 72 "TQL Model" [storyboard p. 71] [Step 4 of 4]

"Return" to "Customer Defines" [storyboard p. 13]

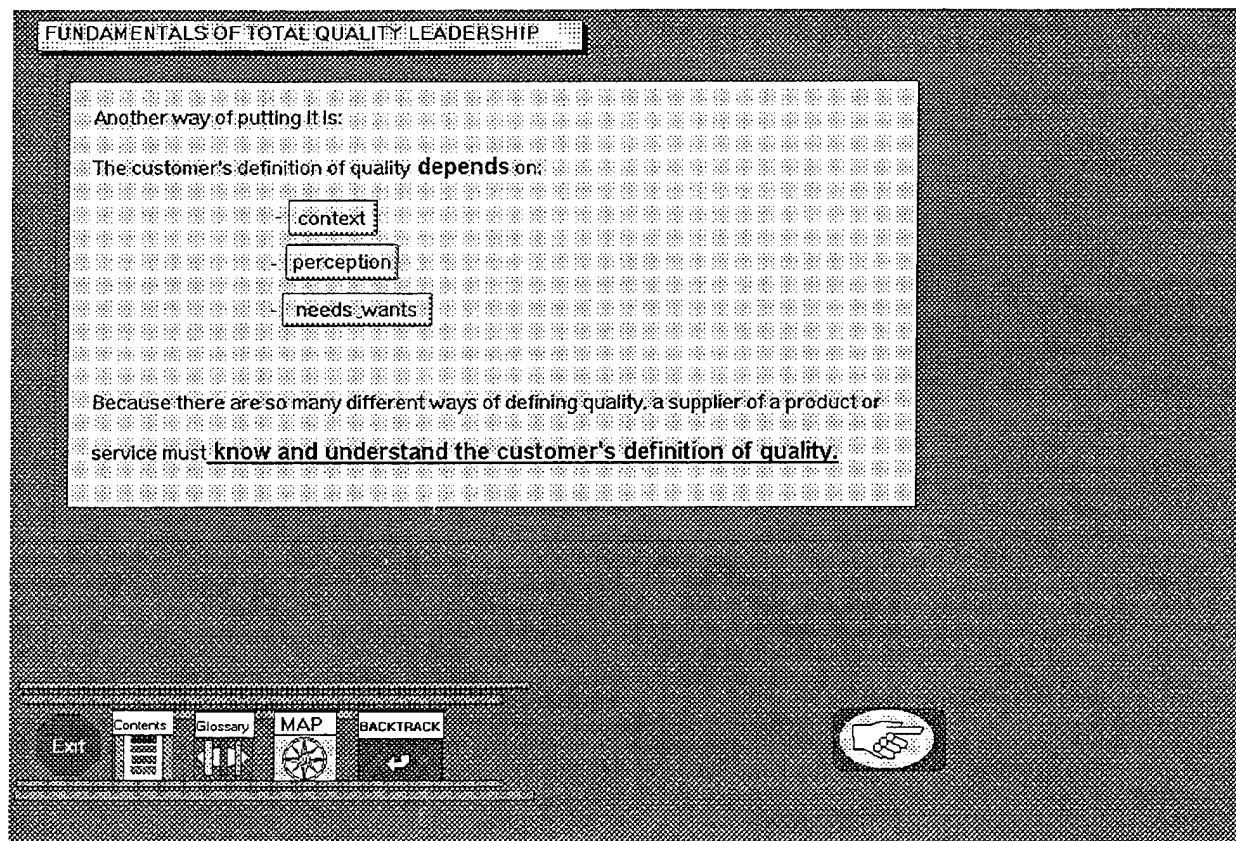


Figure 73 "Quality Depends" [storyboard p. 12]

"Context" to "Context" [storyboard p. 60]

"Perception" to "Perception" [storyboard p. 62]

"Needs & Wants" to "Needs&Wants" [storyboard p. 64]

"Continue" to "Designed in" [storyboard p. 21]

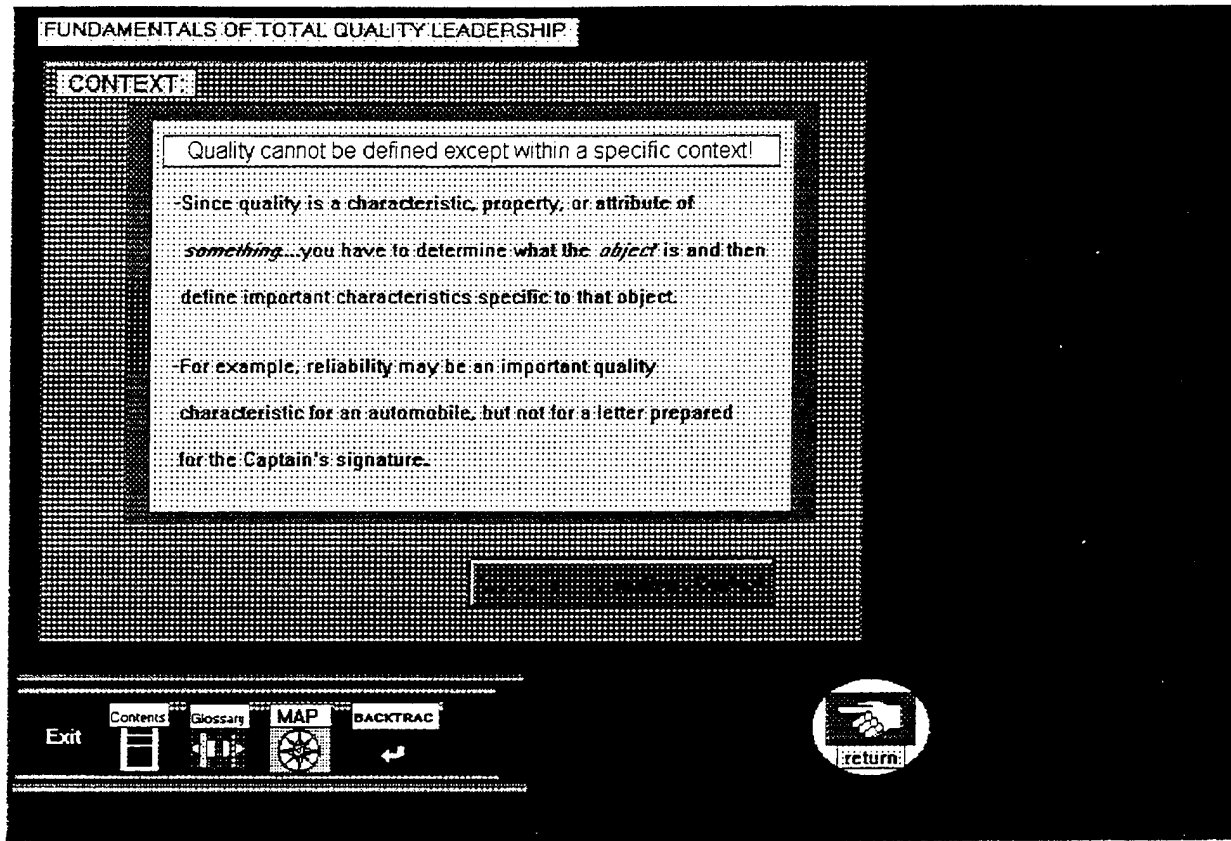


Figure 74 "Context" [storyboard p. 60]

"Additional Information" still under construction
"Return" to "Quality depends" [storyboard p. 12]

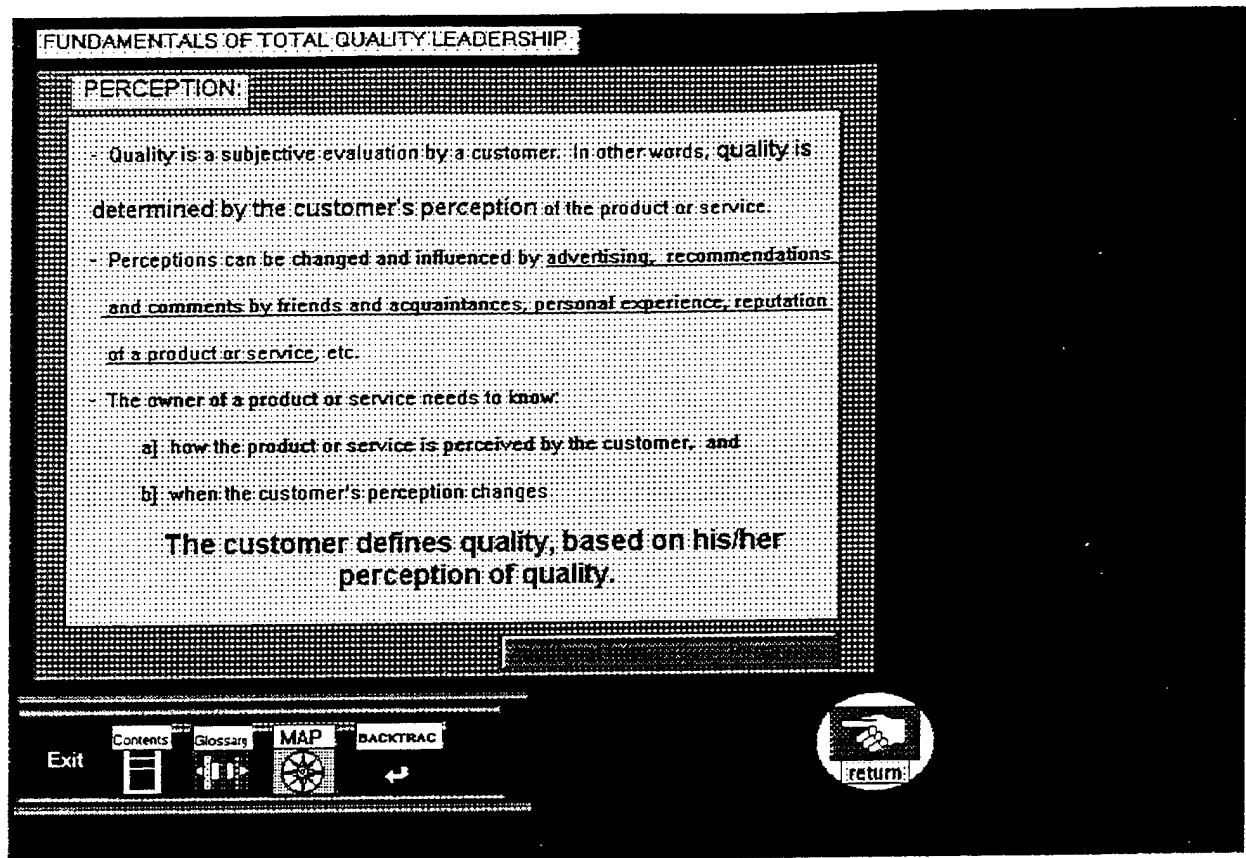


Figure 75 "Perception" [storyboard p. 62]

"Additional Information" still under construction
"Return" to "Quality depends" [storyboard p. 12]

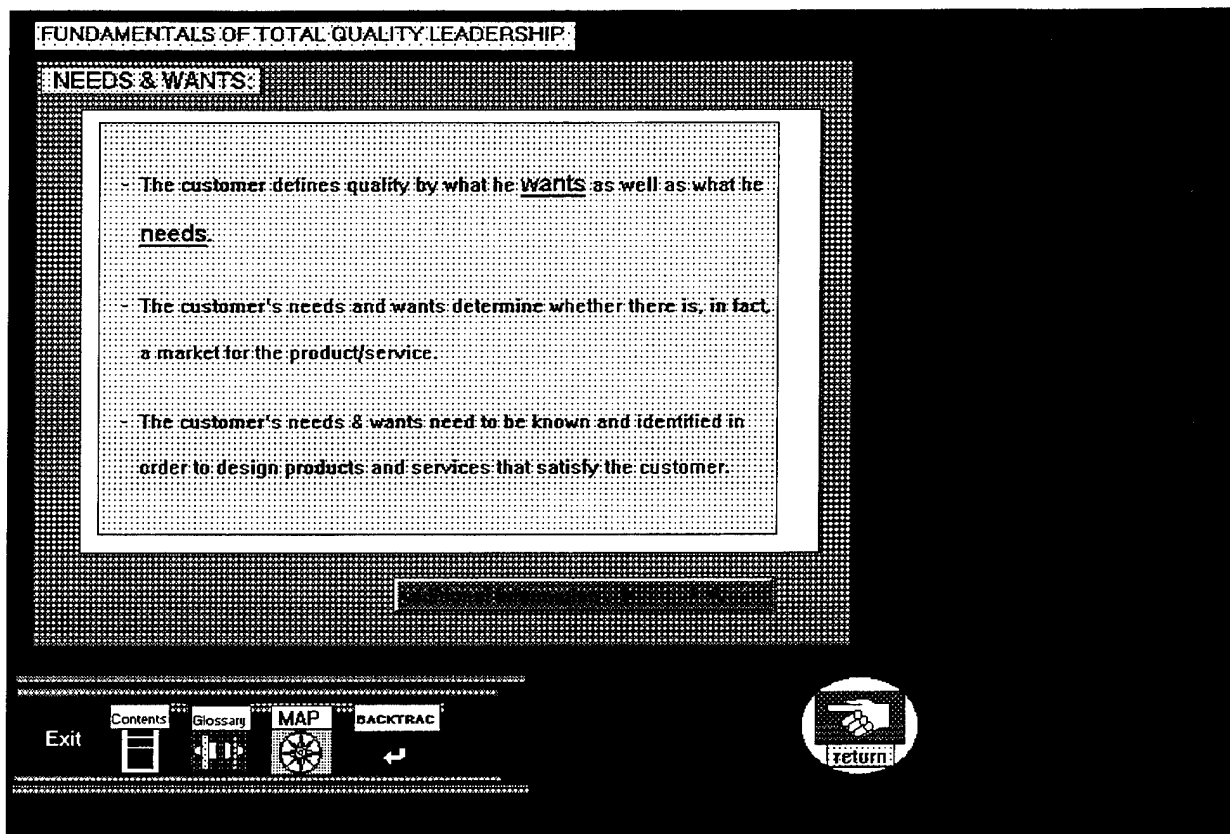


Figure 76 "Needs & Wants" [storyboard p. 64]

"Additional Information" still under construction
"Return" to "Quality depends" [storyboard p. 12]

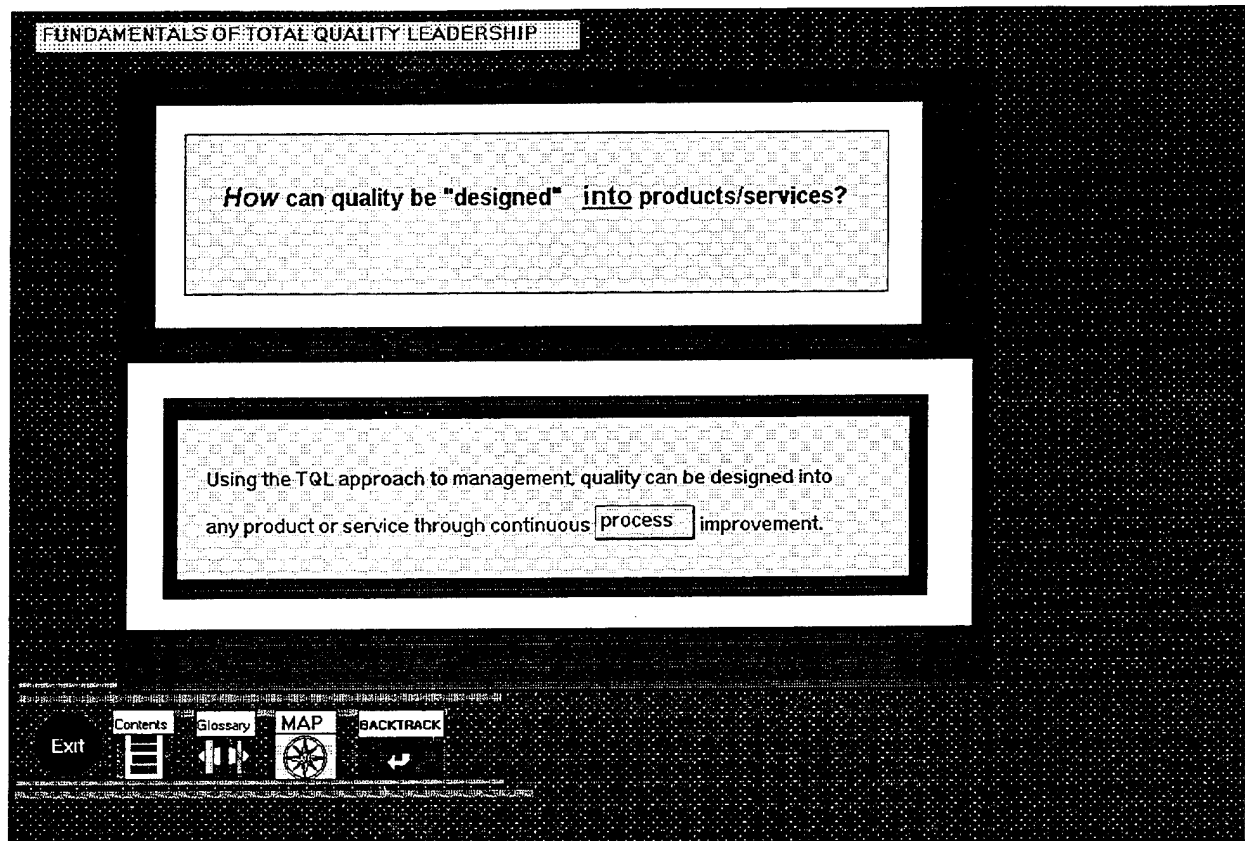


Figure 77 "Designed in" [storyboard p. 21]

"Process" to "Process" [storyboard p. 22]



Figure 78 "Process" [storyboard p. 22] [Step 1 of 2]

"Continue" to "Process" [storyboard p. 22] {Step 2 of 2}

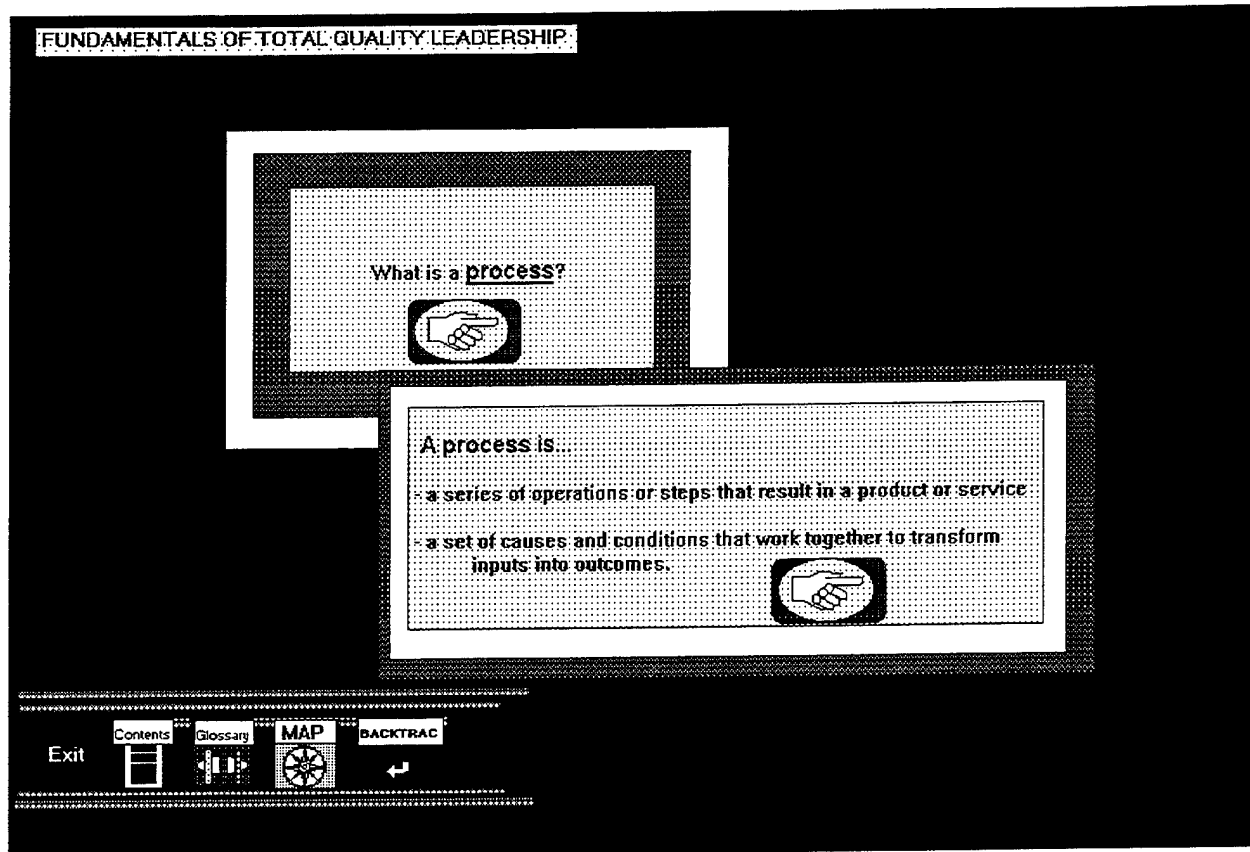


Figure 79 "Process" [storyboard p. 22] [Step 2 of 2]

"Continue" to "Work=Processes" [storyboard p. 23]

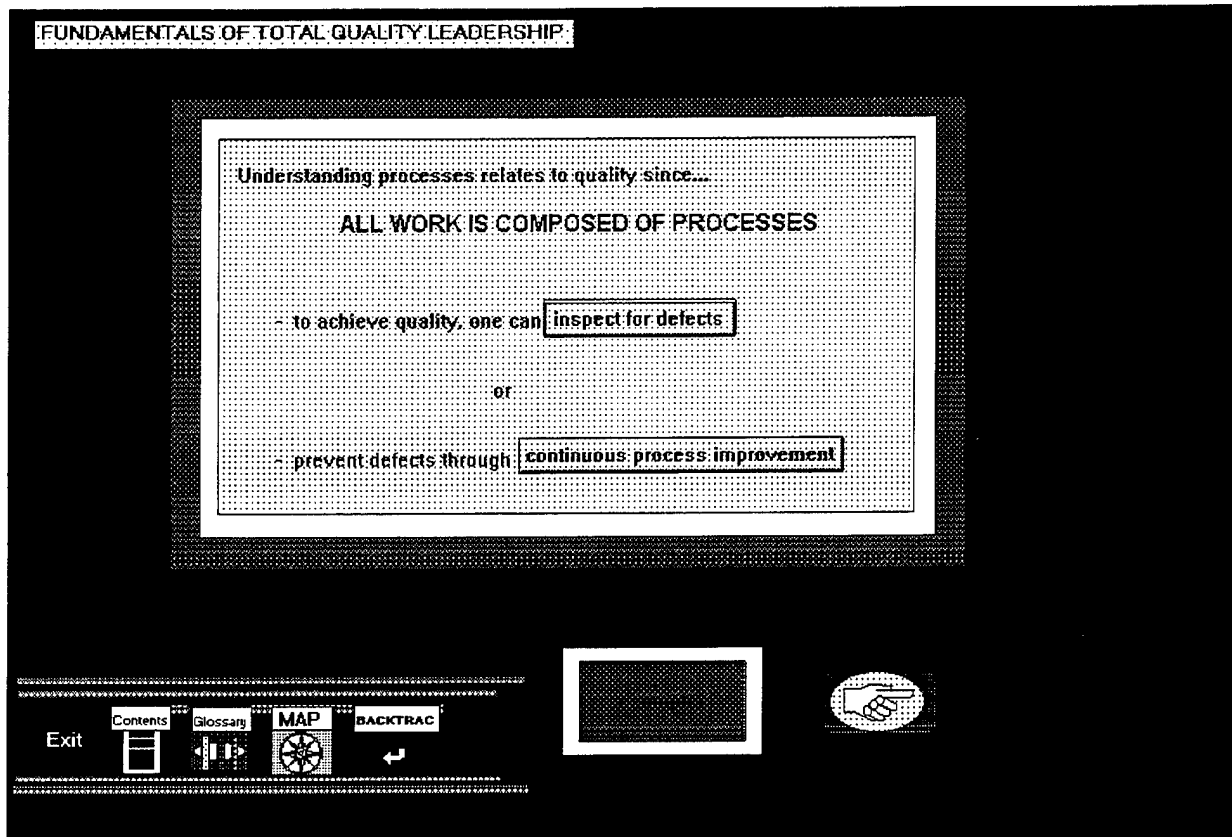


Figure 80 "Work=Processes" [storyboard p. 23]

"inspect for defects" to "Inspection for Defects" [storyboard p. 69]

"continuous process improvement" to "Continuous Improvement"
[storyboard p. 44]

"Examples" to "Process Examples" [storyboard p. 67]

"Continue" to "Setup for TQL Definition" [storyboard p. 24]

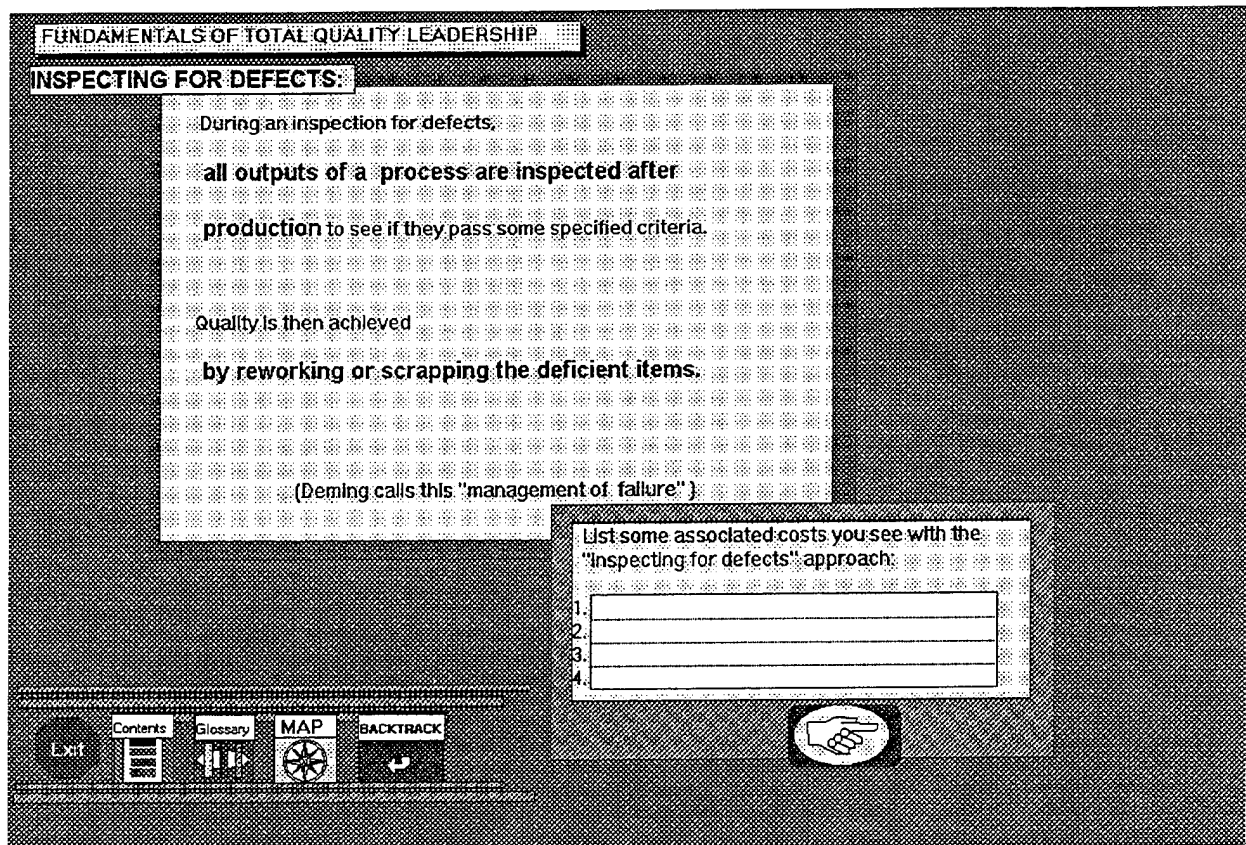


Figure 81 "Inspection for Defects" [storyboard p. 69]

This toolbook page required interaction by the student to enter associated costs.
"Continue" < Enter Key > to "Costs" [storyboard p. 70]

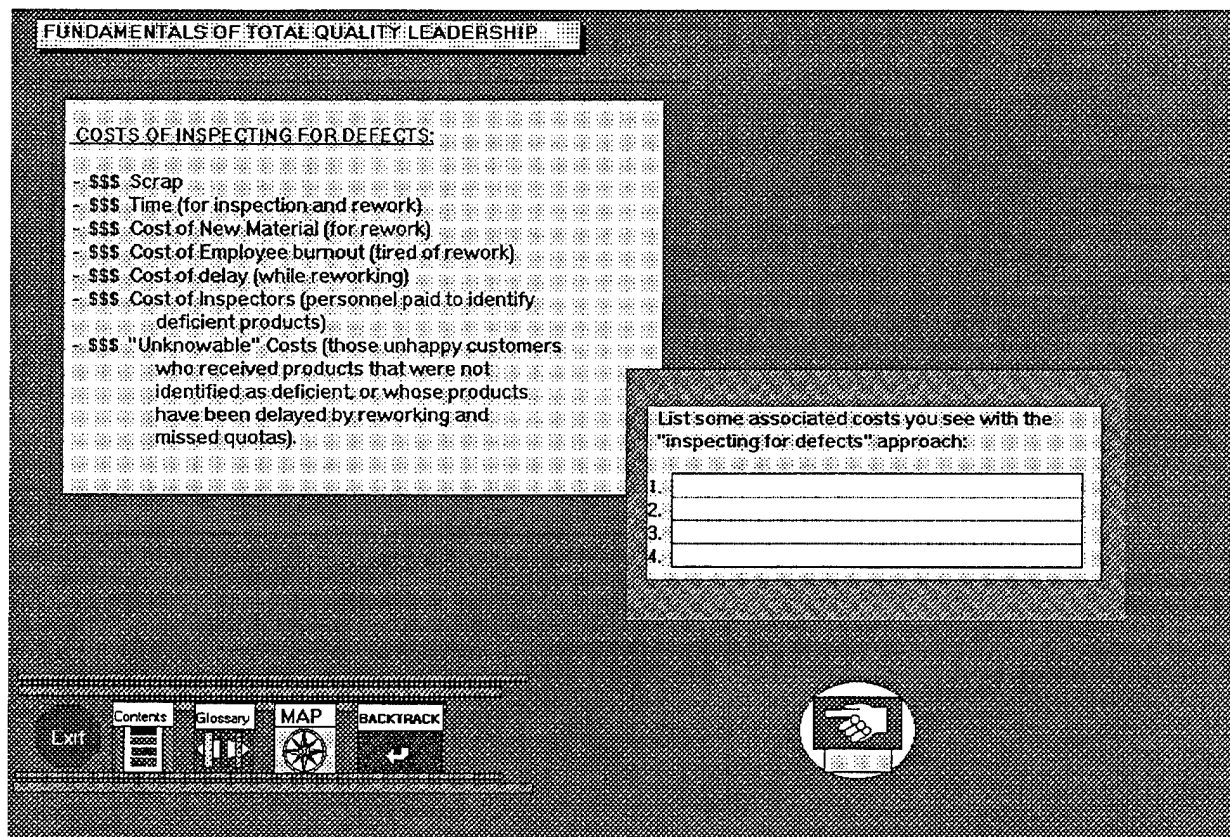


Figure 82 "Costs" [storyboard p. 70]

This toolbook page displays the associated costs entered by the student on the previous page (Storyboard p. 69) for comparison with list.
 "Return" to "Work=Processes" [storyboard p. 23]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

CONTINUOUS PROCESS IMPROVEMENT

Achieving the highest levels of quality and competitiveness requires a well-defined and well-executed approach to continuous improvement. Continuous improvement can take many forms:

- enhancing value to the customer through new and improved products and services
- reducing errors, defects, and waste
- improving responsiveness and cycle time performance
- improving productivity and effectiveness in the use of all resources

To meet all of these objectives, the process of continuous improvement must contain regular cycles of planning, execution, and evaluation. This requires a basis - preferably a quantitative basis - for assessing progress, and for deriving information for future cycles of improvement. Statistical Process Control tools are used for measuring and monitoring the improvement process.



Figure 83 "Continuous Improvement" [storyboard p. 44]

"Return" to "Work=Processes" [storyboard p. 23]

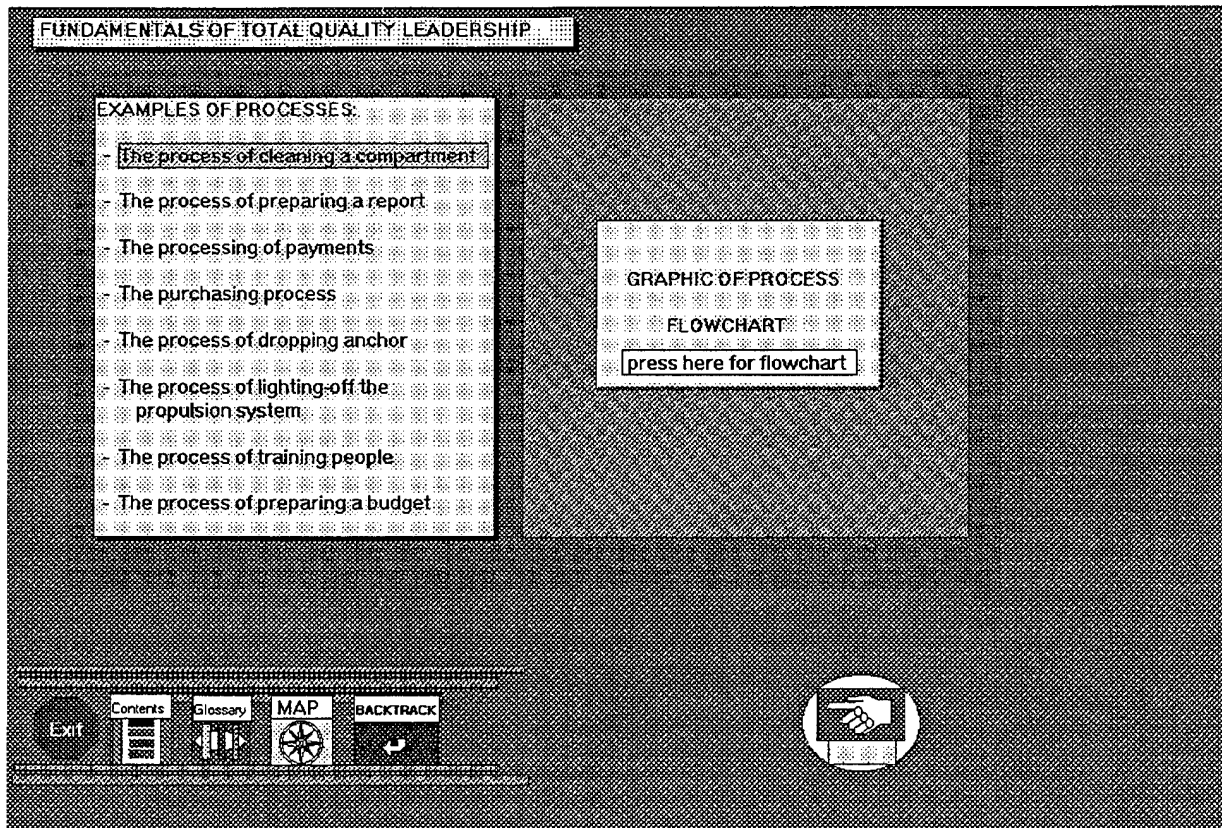


Figure 84 "Process examples" [storyboard p. 67]

"Graphic of Process Flowchart" to "Flowchart" [storyboard p. 68]

"Return" to "Work=Processes" [storyboard p. 23]

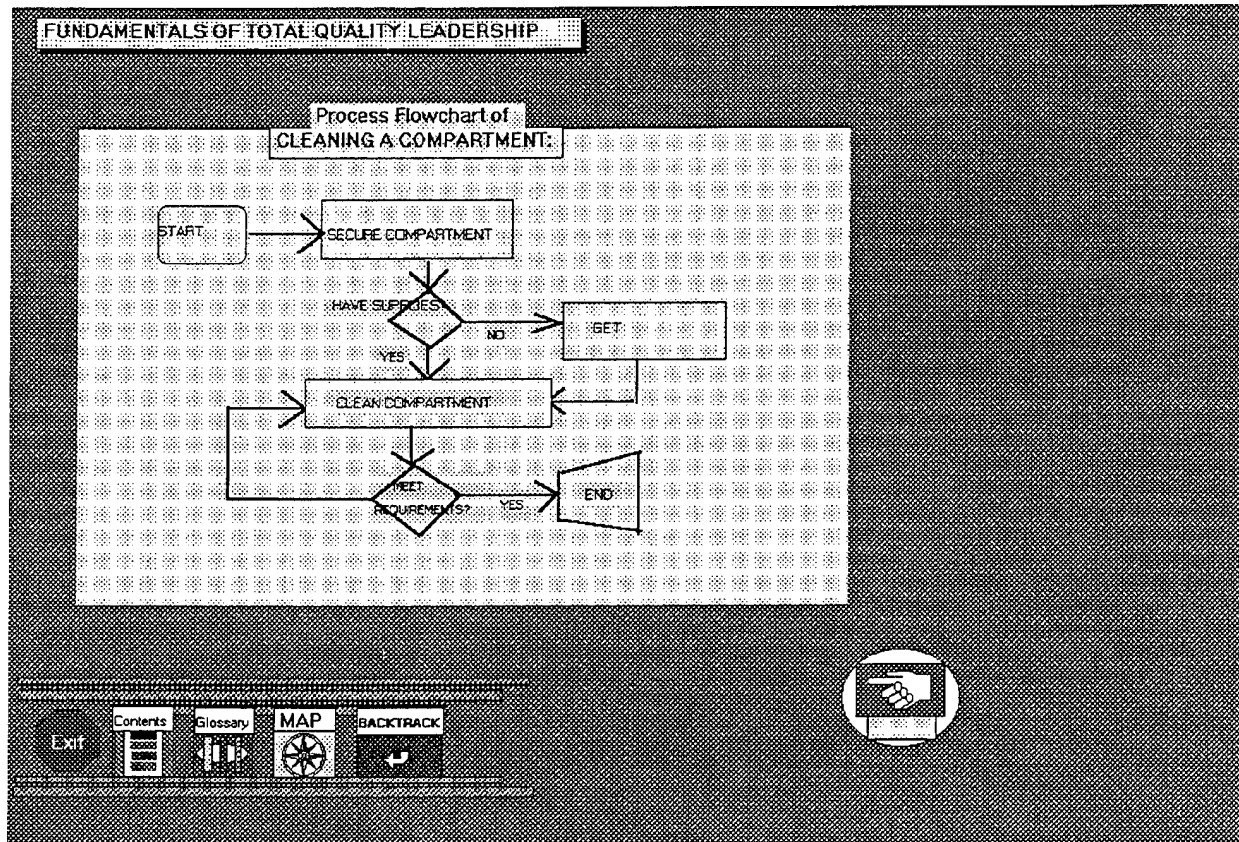


Figure 85 "Flowchart" [storyboard p. 68]

"Return" to "Process examples" [storyboard p. 67]

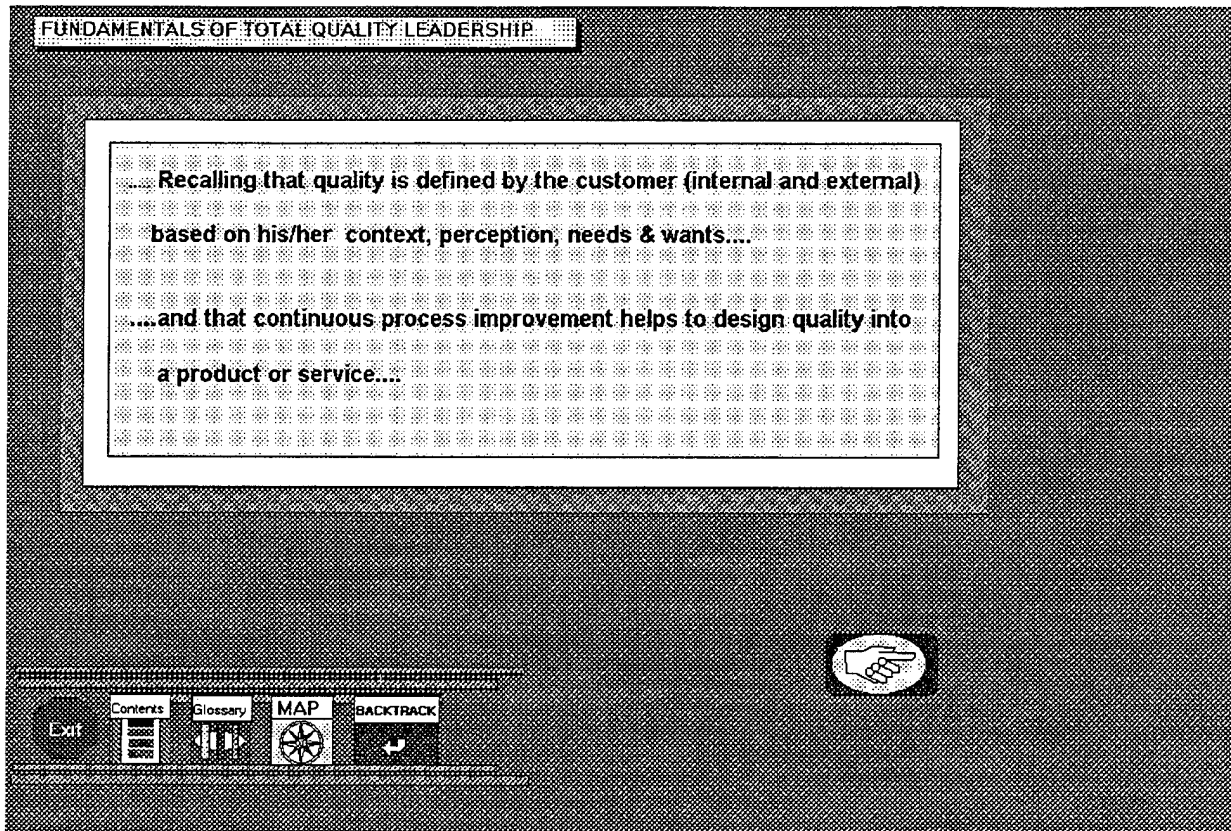


Figure 86 "Setup for TQL Definition" [storyboard p. 24]

"Continue" to "TQL Definition" [storyboard p. 25]

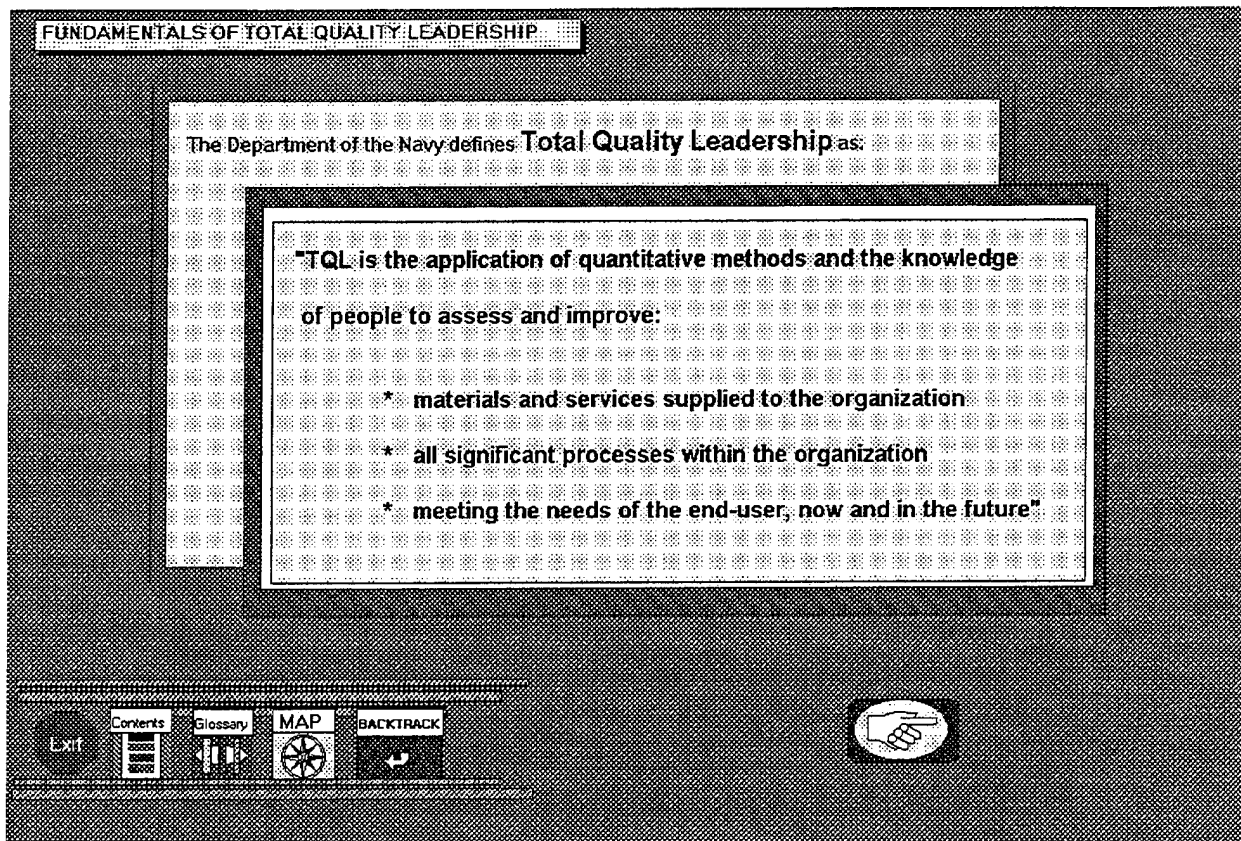


Figure 87 "TQL Definition" [storyboard p. 25]

"Continue" to "TQL" [storyboard p. 28]

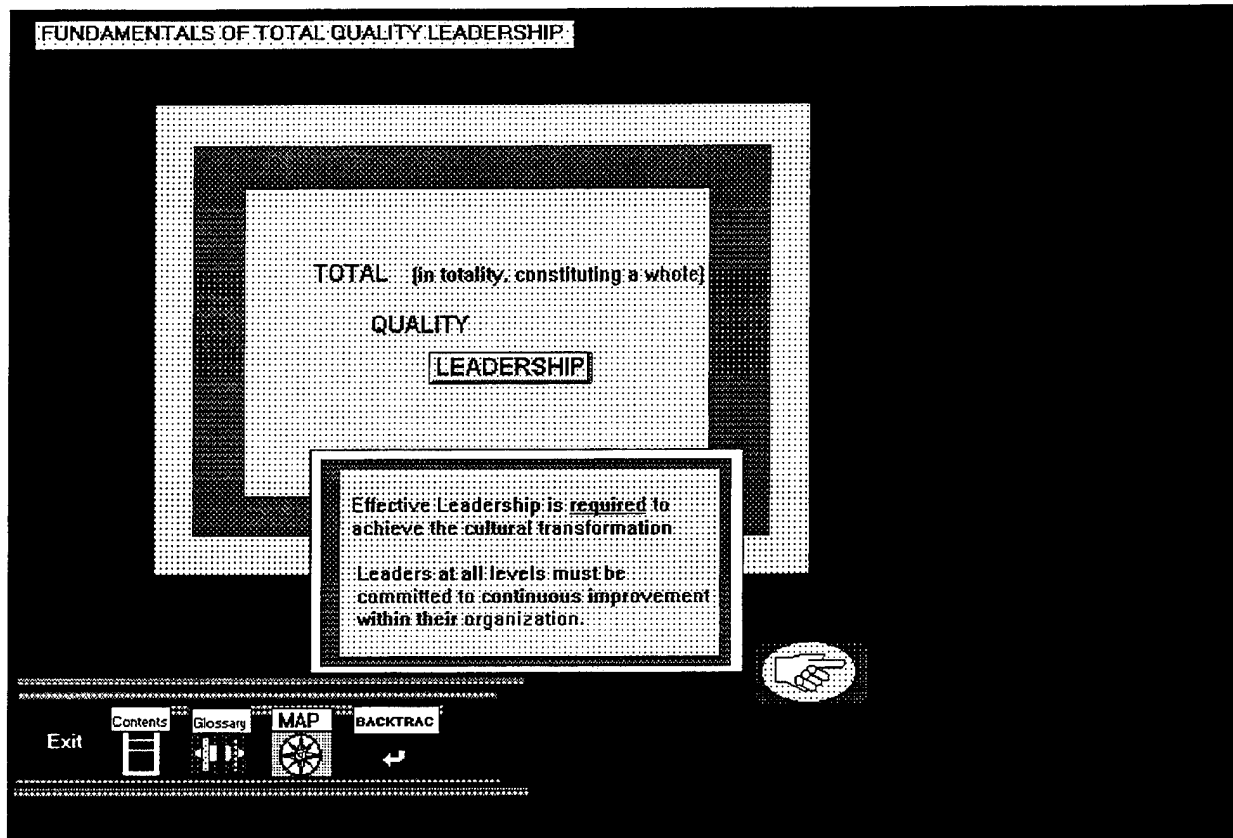


Figure 88 "TQL" [storyboard p. 28]

"Leadership" to "Leadership is" [storyboard p. 29]

"Continue" to "Why Navy Focus?" [storyboard p. 26]

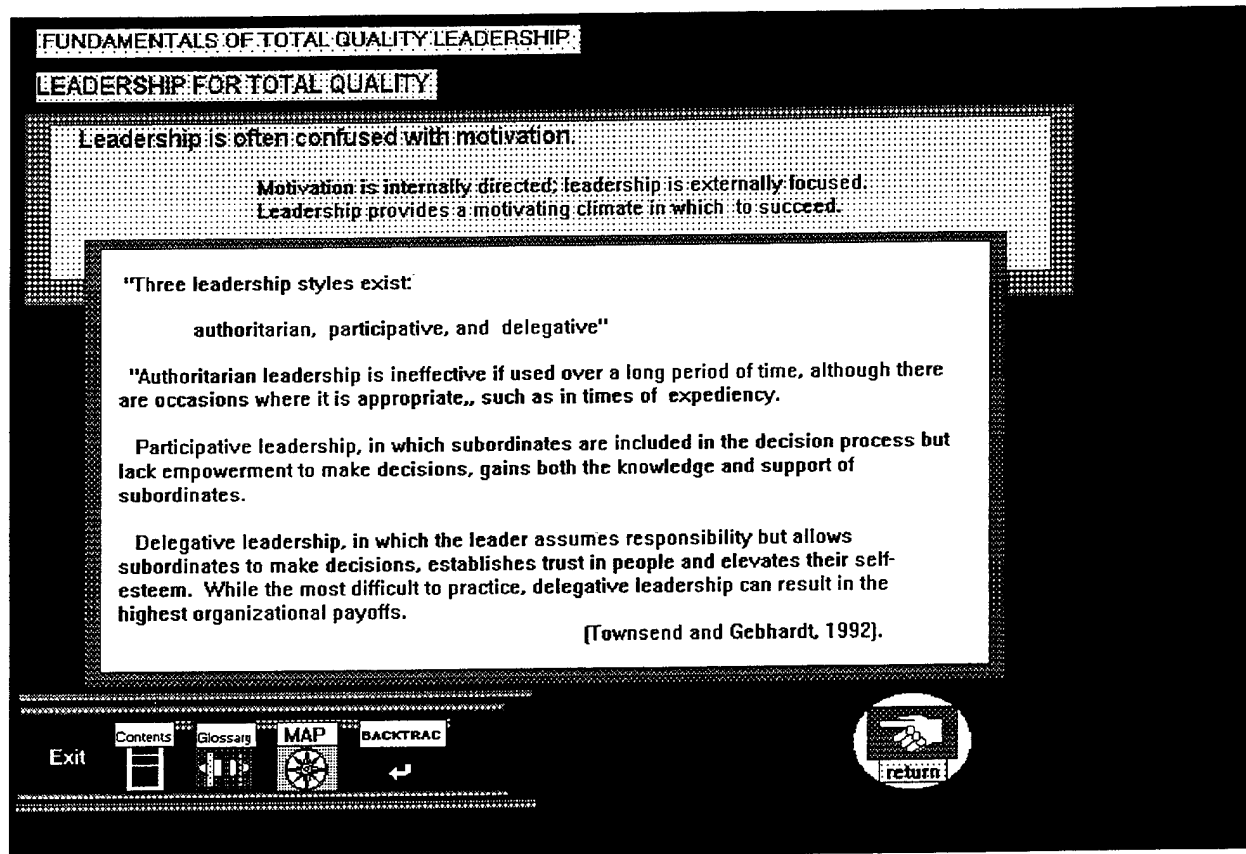


Figure 89 "Leadership is" [storyboard p. 29]

"Return" to "TQL" [storyboard p. 28]

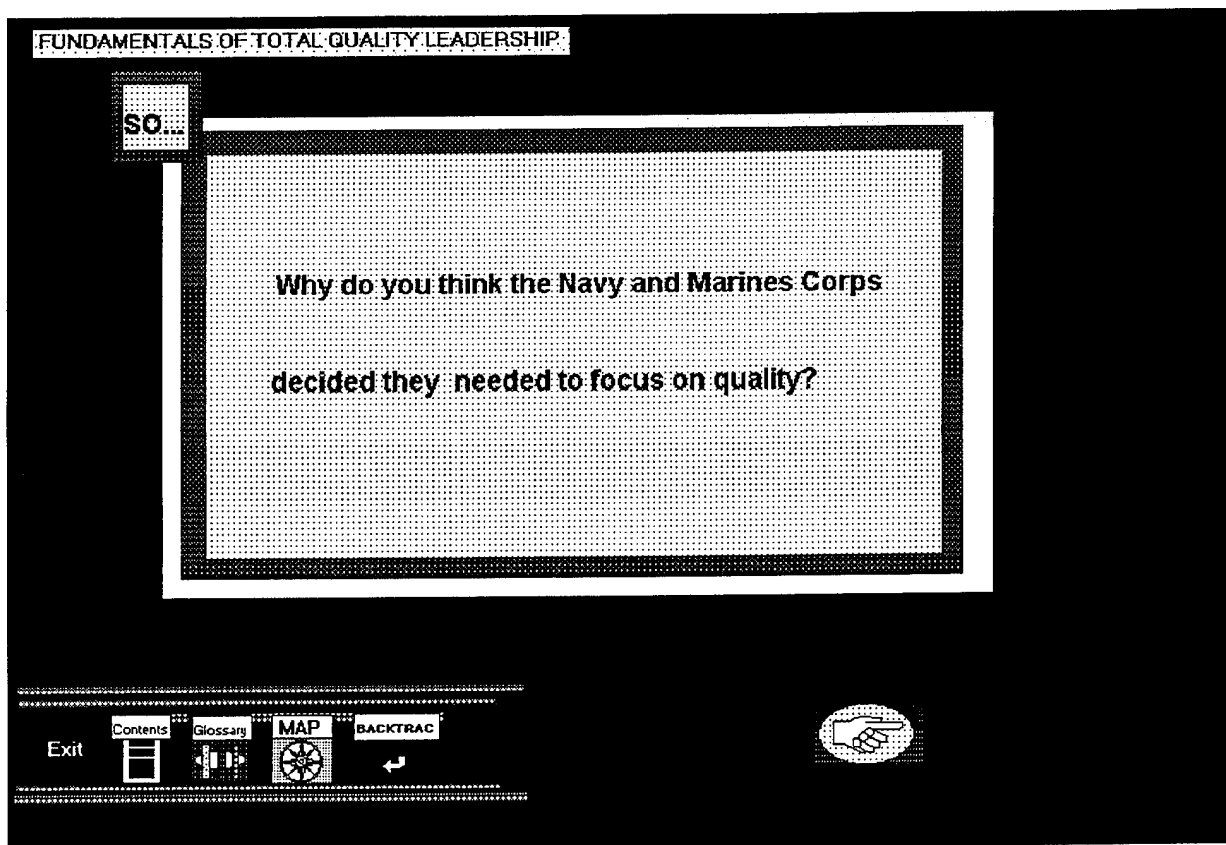


Figure 90 "Why Navy Focus" [storyboard p. 26]

"Continue" to "Reasons for TQL Focus" [storyboard p. 27]

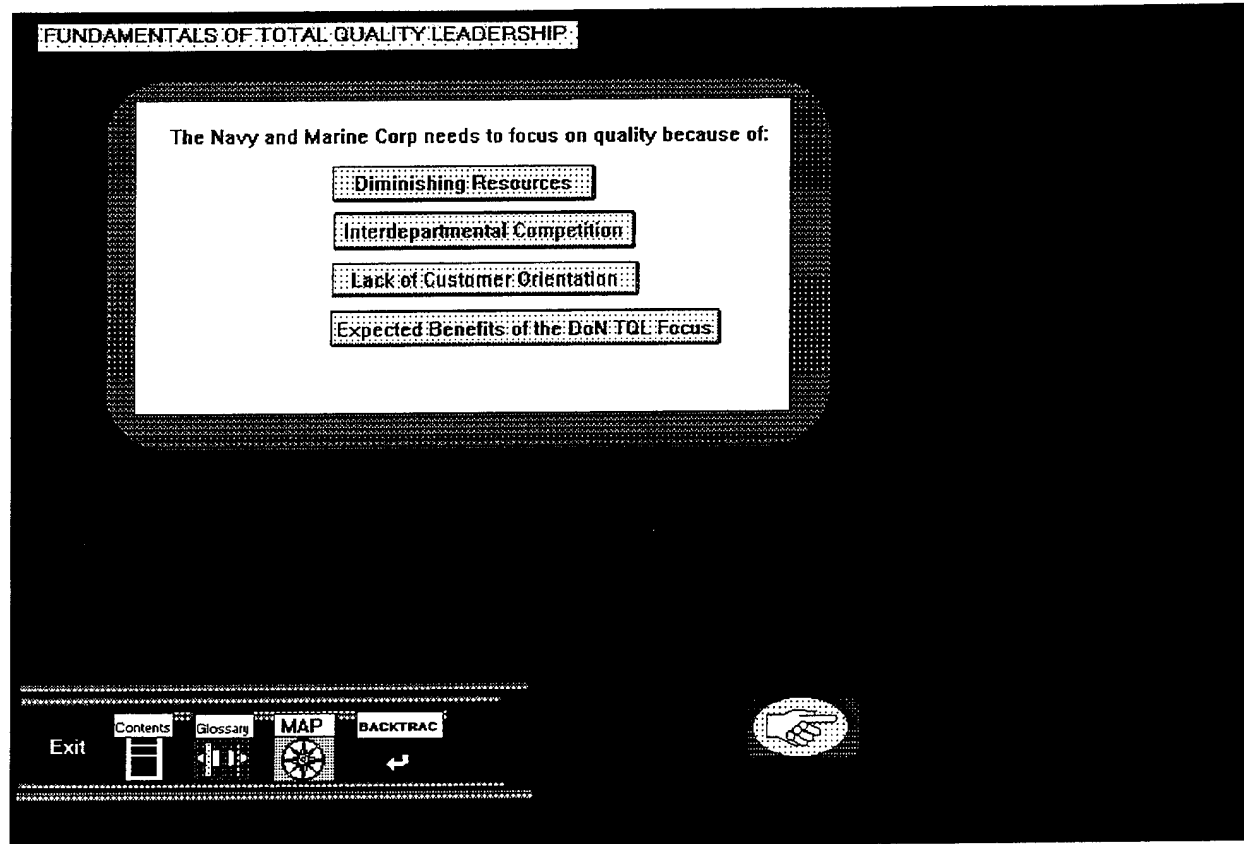


Figure 91 "Reasons for TQL Focus" [storyboard p. 27]

"Diminishing Resources" to "Diminishing Resources" [storyboard p. 74]

"Interdepartmental Competition" to "Interdepartmental Competition" [storyboard p. 75]

"Lack of Customer Orientation" to "Customer Orientation" [storyboard p. 76]

"Expected Benefits of the DoN TQL Focus" to "Expected Benefits"
[storyboard p. 72]

"Continue" to "Customer Feedback" [storyboard p. 31]

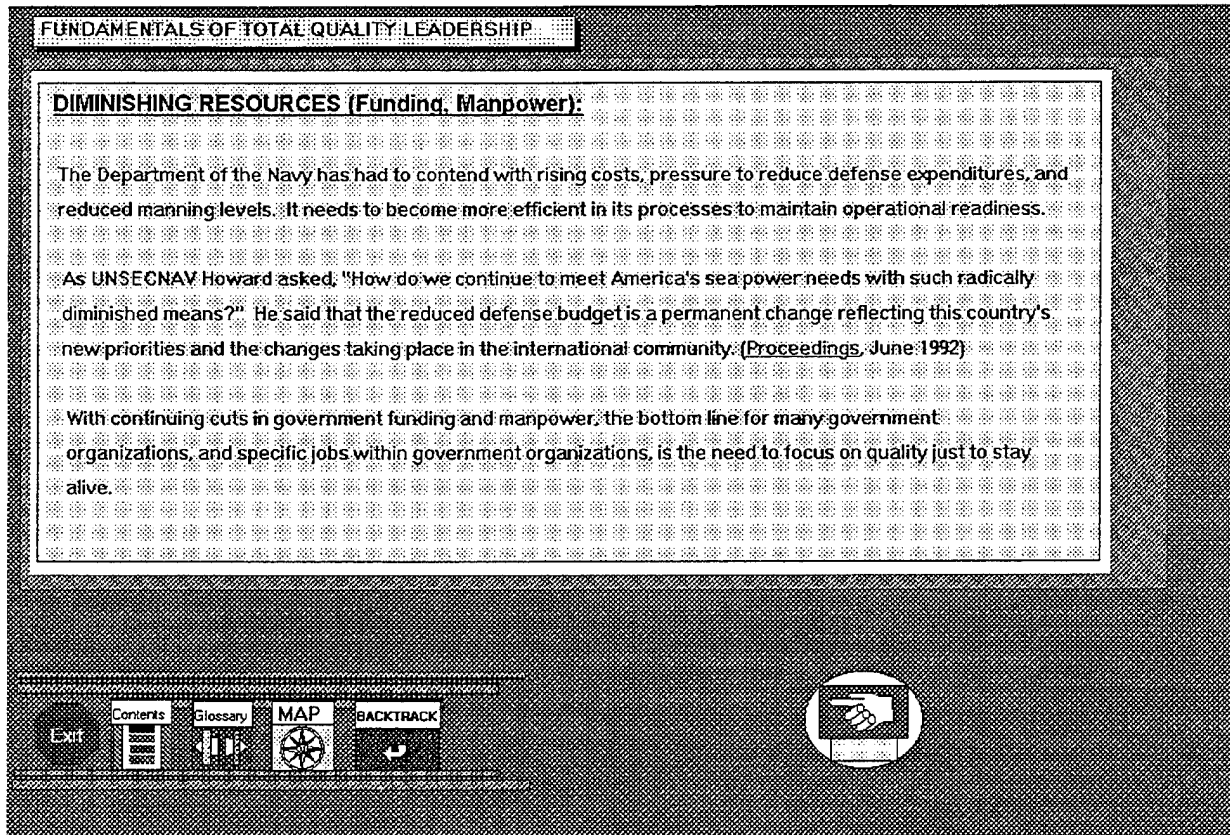


Figure 92 "Diminishing Resources" [storyboard p. 74]

"Return" to "Reasons for TQL Focus" [storyboard p. 27]

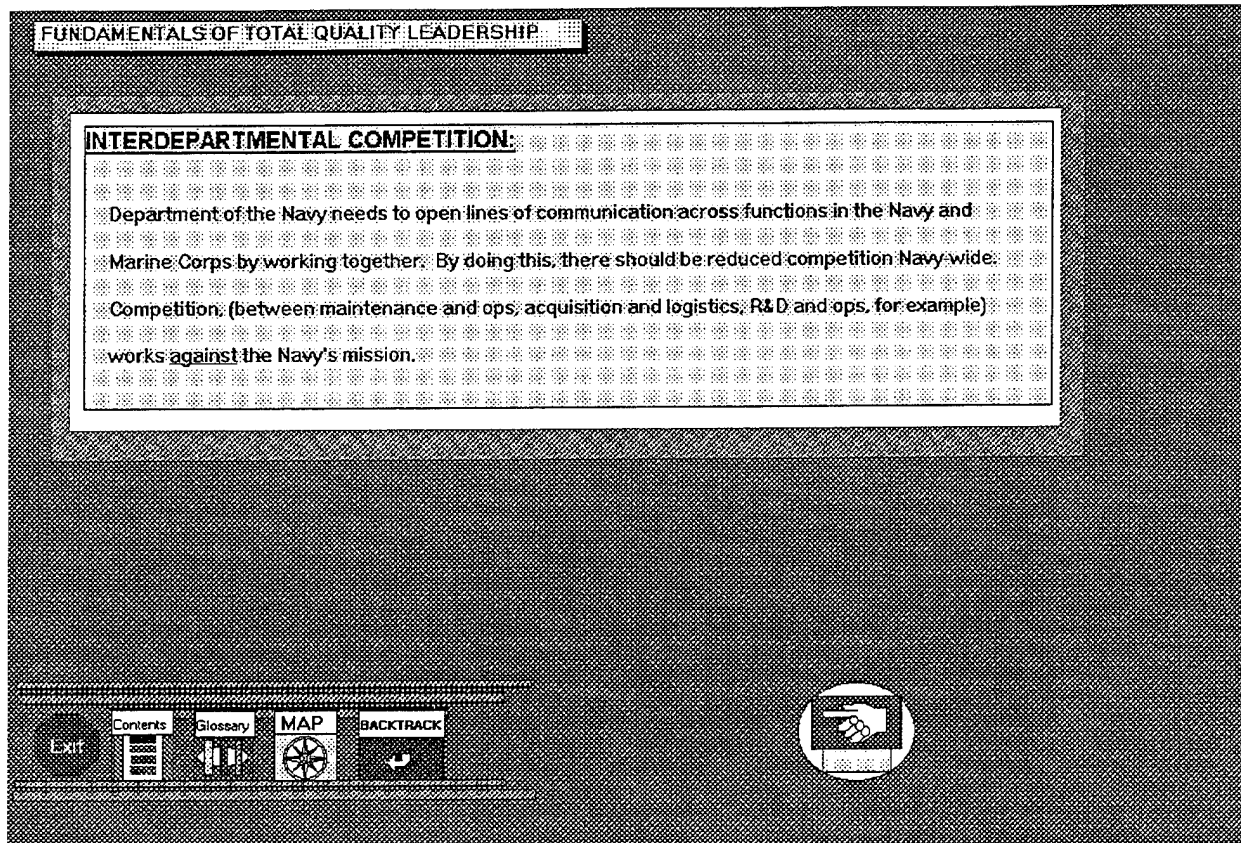


Figure 93 "Interdepartmental Competition" [storyboard p. 75]

"Return" to "Reasons for TQL Focus" [storyboard p. 27]

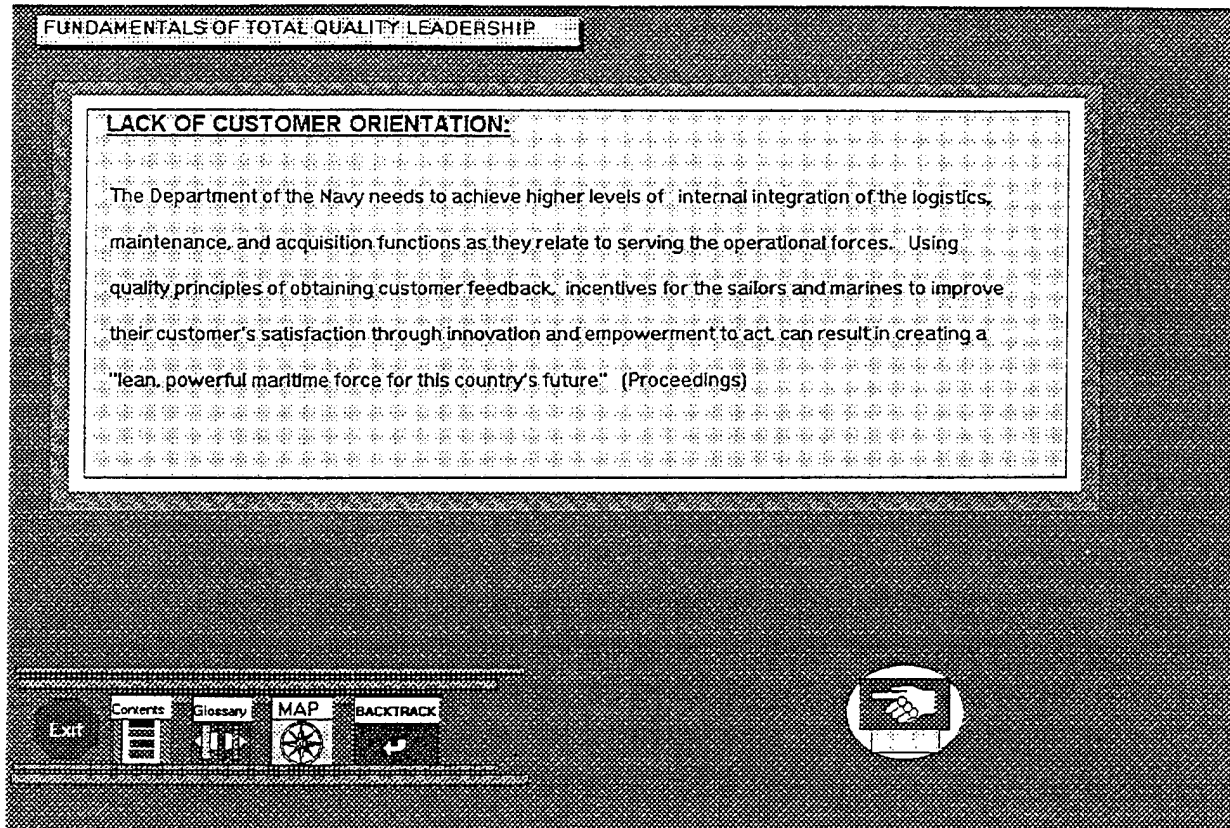


Figure 94 "Customer Orientation" [storyboard p. 76]

"Return" to "Reasons for TQL Focus" [storyboard p. 27]

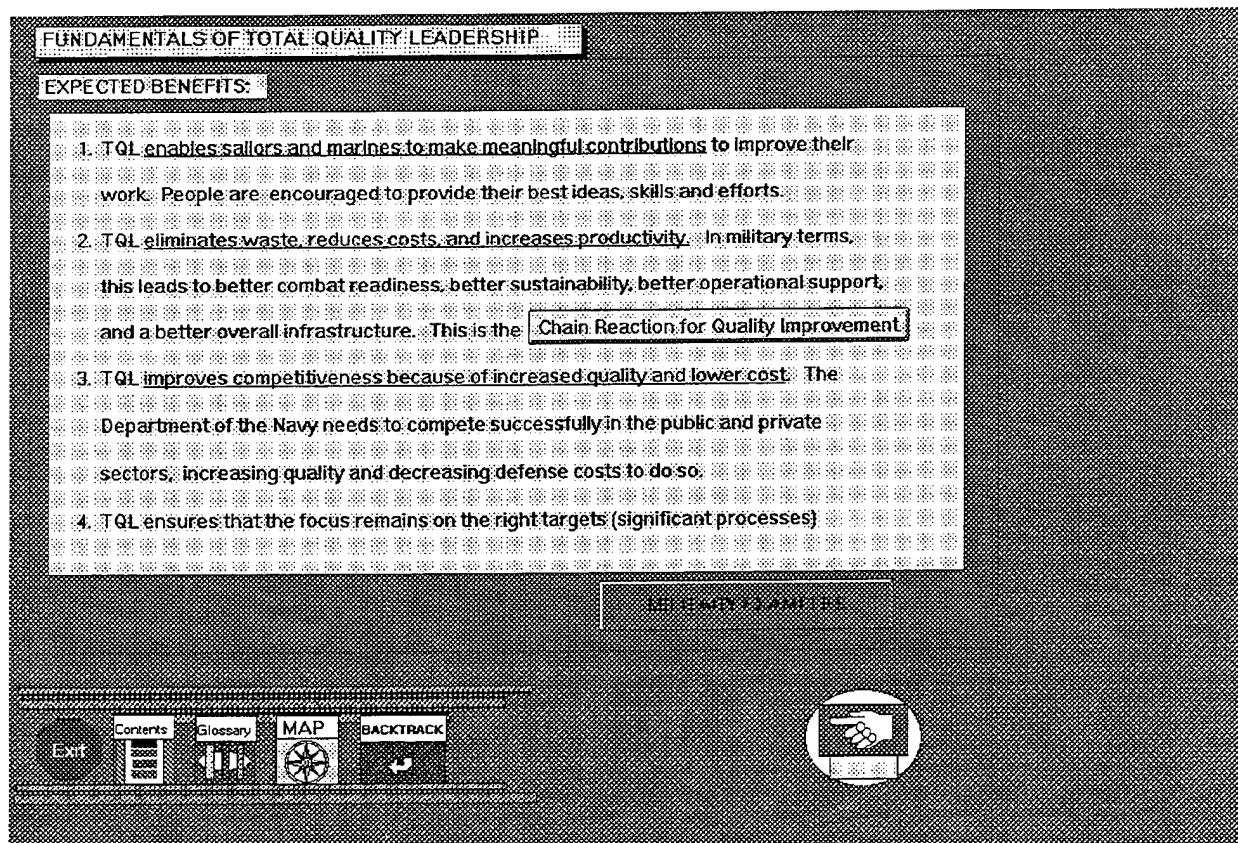


Figure 95 "Expected Benefits" [storyboard p. 72]

"Chain Reaction for Quality Improvement" to "Chain Reaction"
[storyboard p. 30]

"Military Examples" to "Mil-examples" [storyboard p. 73]

"Return" to "Reasons for TQL Focus" [storyboard p. 27]

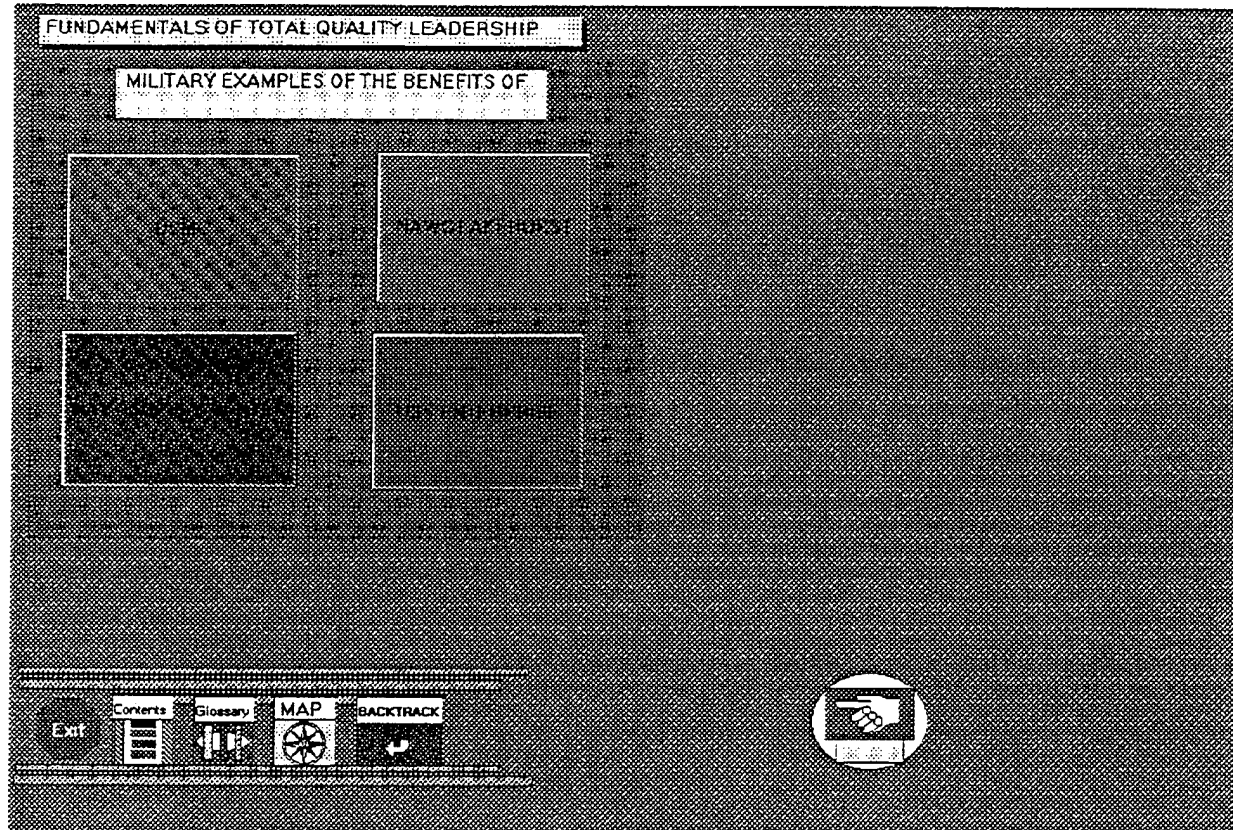


Figure 96 "Mil-examples" [storyboard p. 73]

"Return" to "Expected Benefits" [storyboard p. 72]
All other buttons still under construction

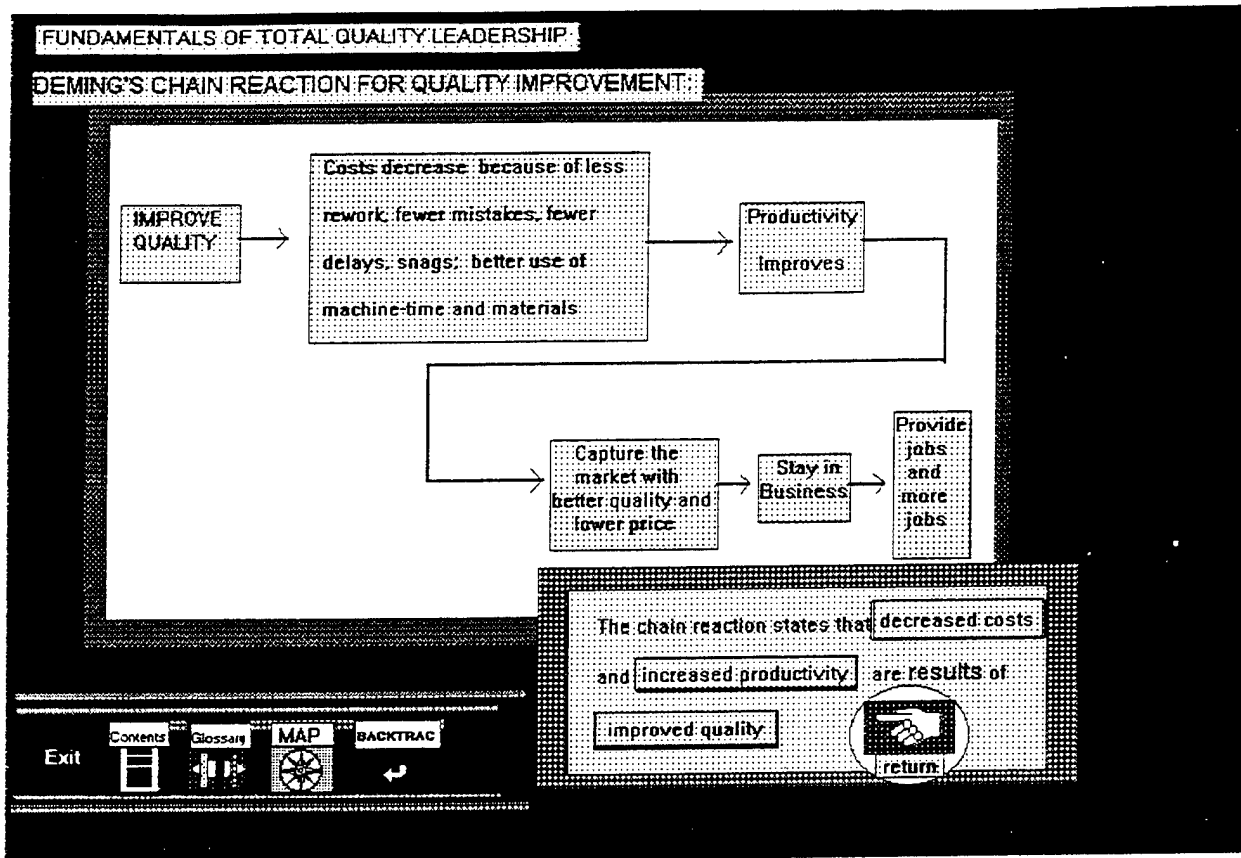


Figure 97 "Chain Reaction" [storyboard p. 30]

The buttons "decreased costs", "increased productivity", and "improved quality" highlight the appropriate text blocks when pressed.

"Return" to "Expected Benefits" [storyboard p. 72]

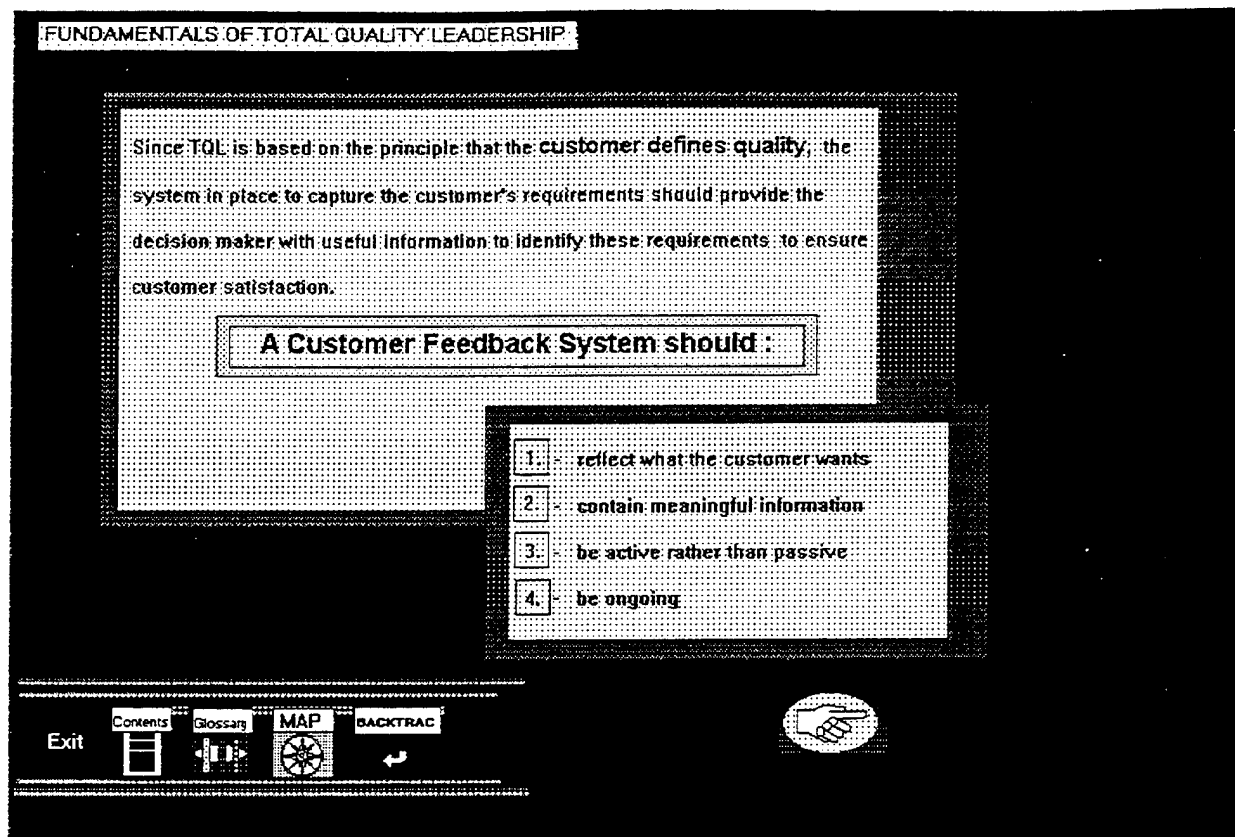


Figure 98 "Customer Feedback" [storyboard p. 31]

"Continue" to "Review 1-1" [storyboard p. 32]

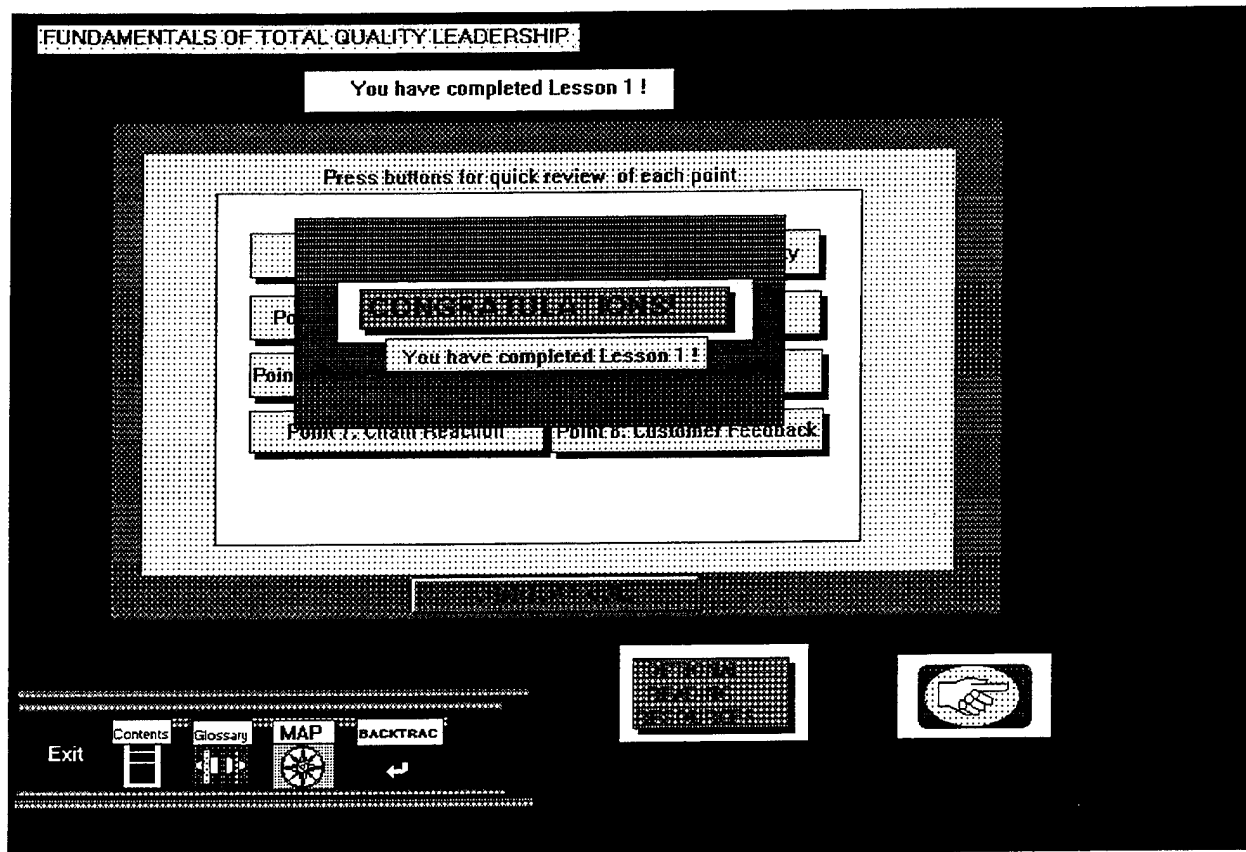


Figure 99 "Review 1-1" [storyboard p. 32] [Step 1 of 10]

"Congratulations Screen holds for 2 seconds, then disappears to [Step 2 of 2]

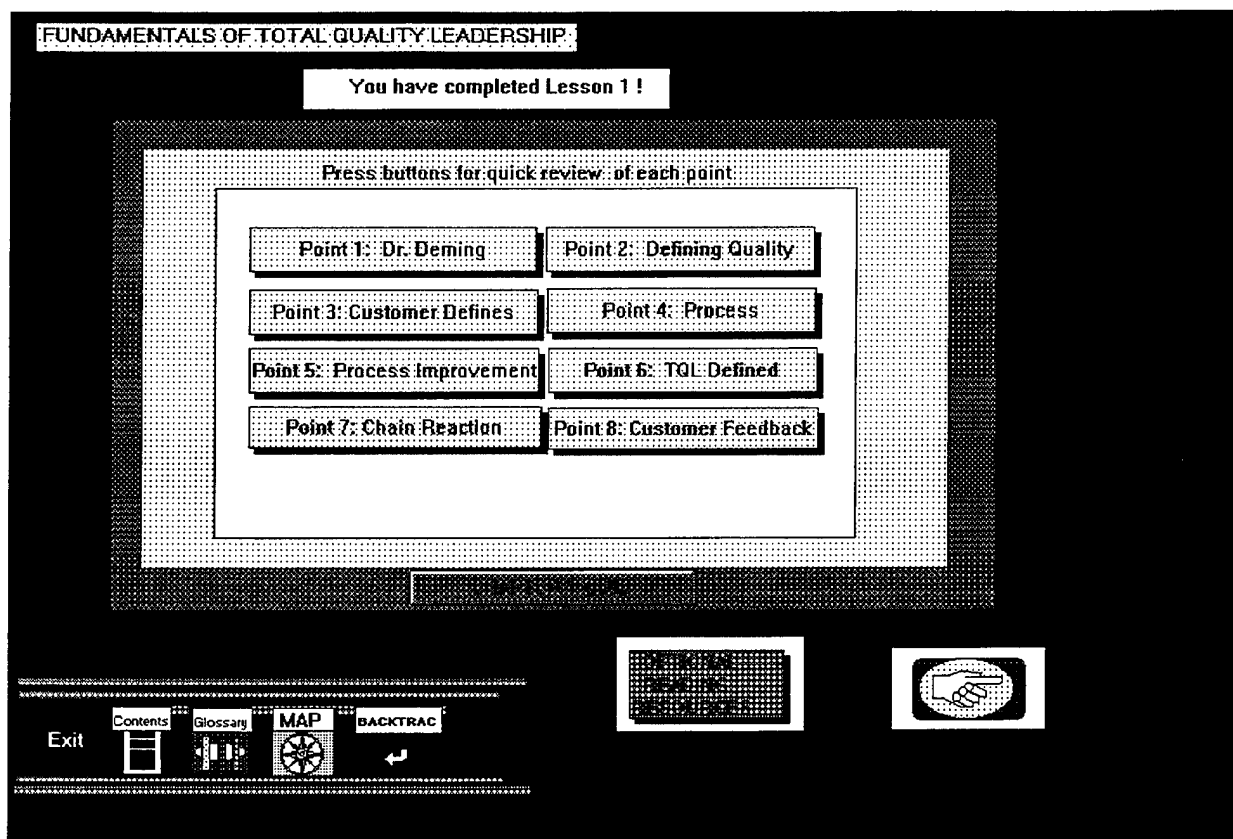


Figure 100 "Review 1-1" [storyboard p. 32] [Step 2 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

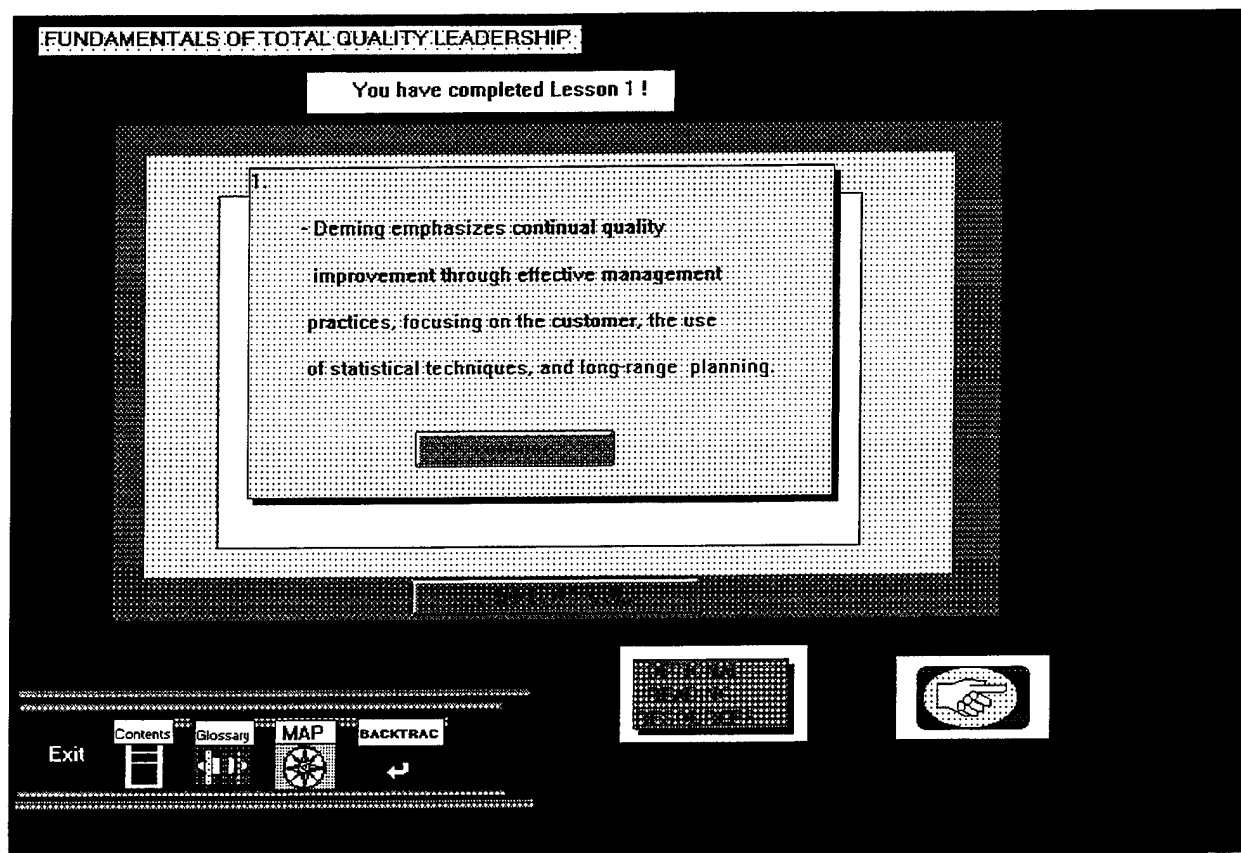


Figure 101 "Review 1-1" [storyboard p. 32] [Step 3 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

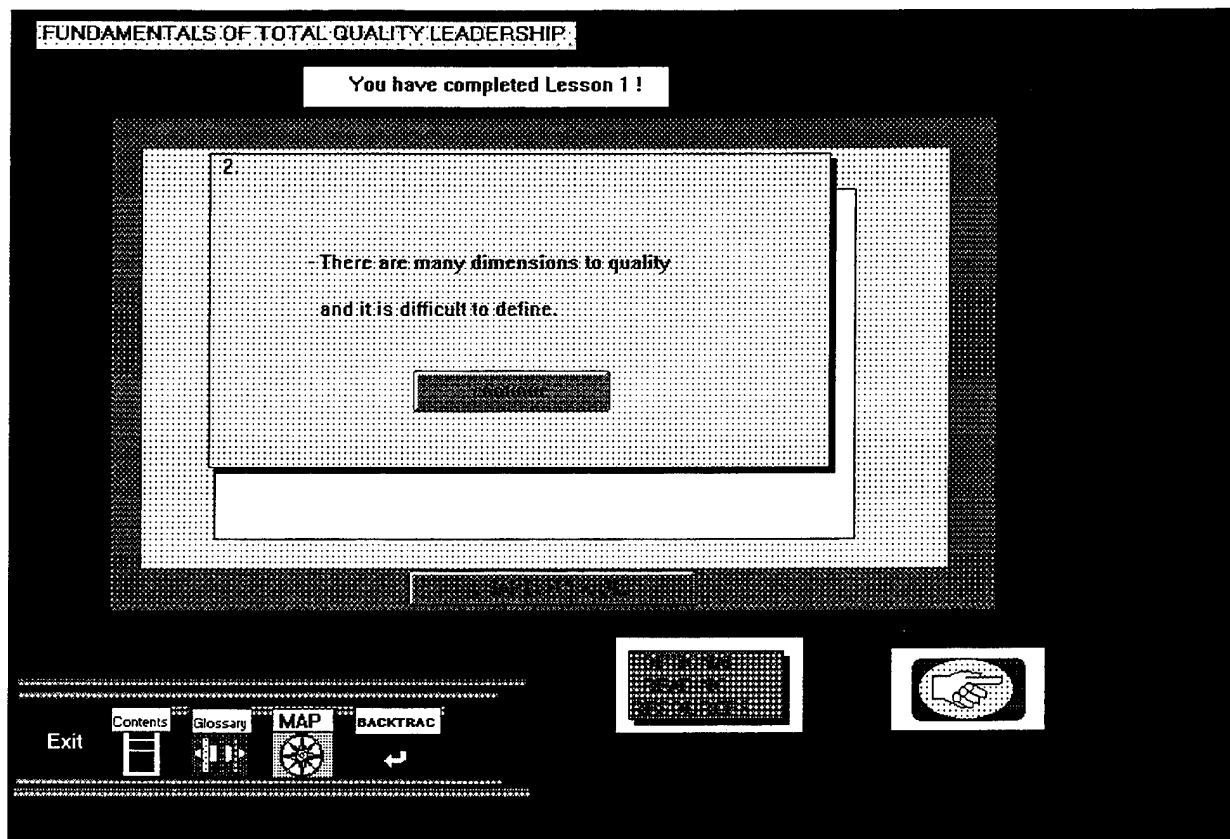


Figure 102 "Review 1-1" [storyboard p. 32] [Step 4 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

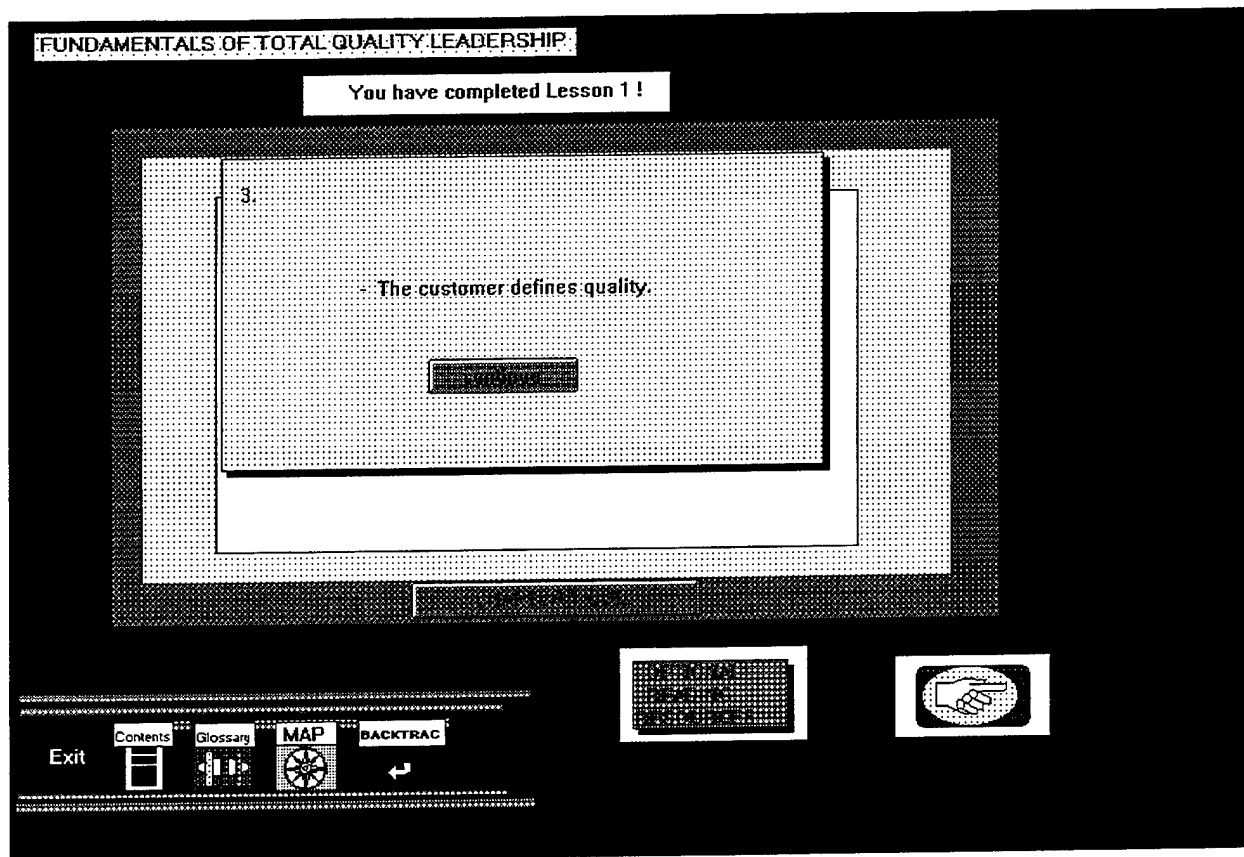


Figure 103 "Review 1-1" [storyboard p. 32] [Step 5 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

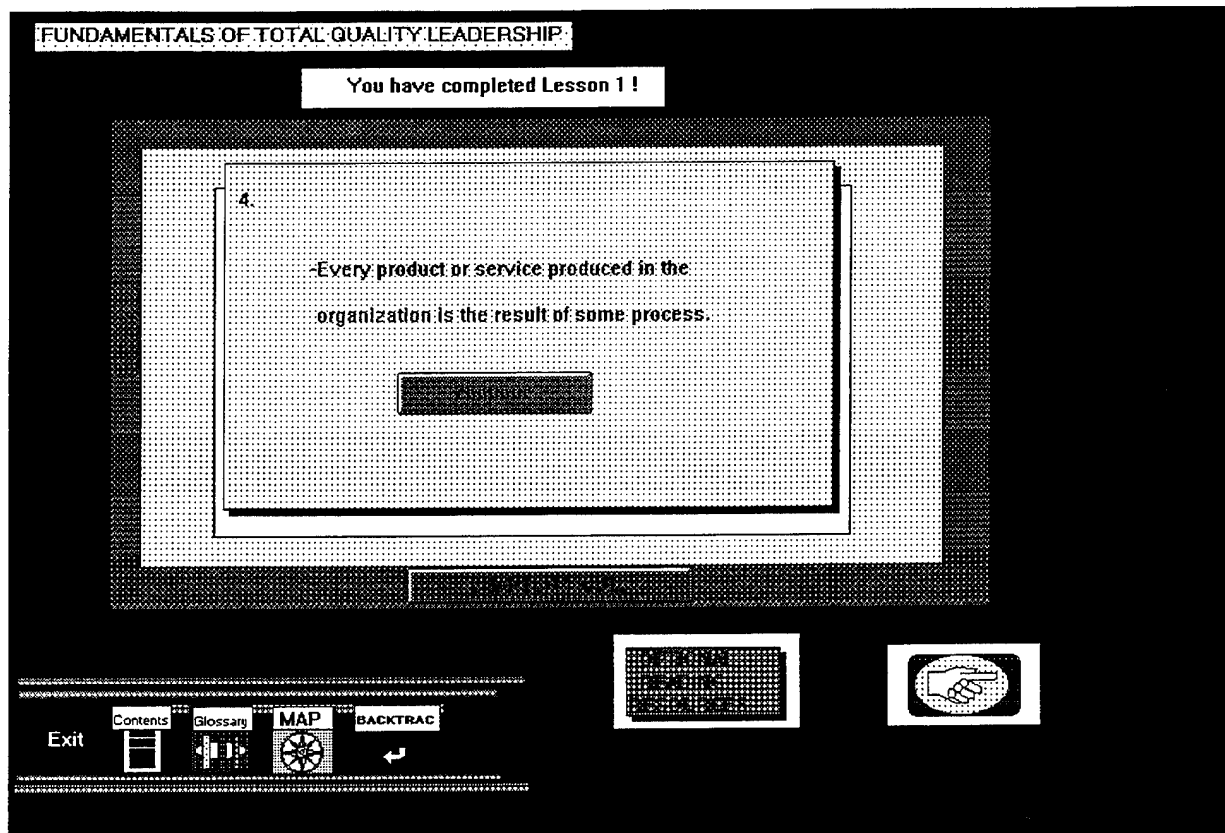


Figure 104 "Review 1-1" [storyboard p. 32] [Step 6 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

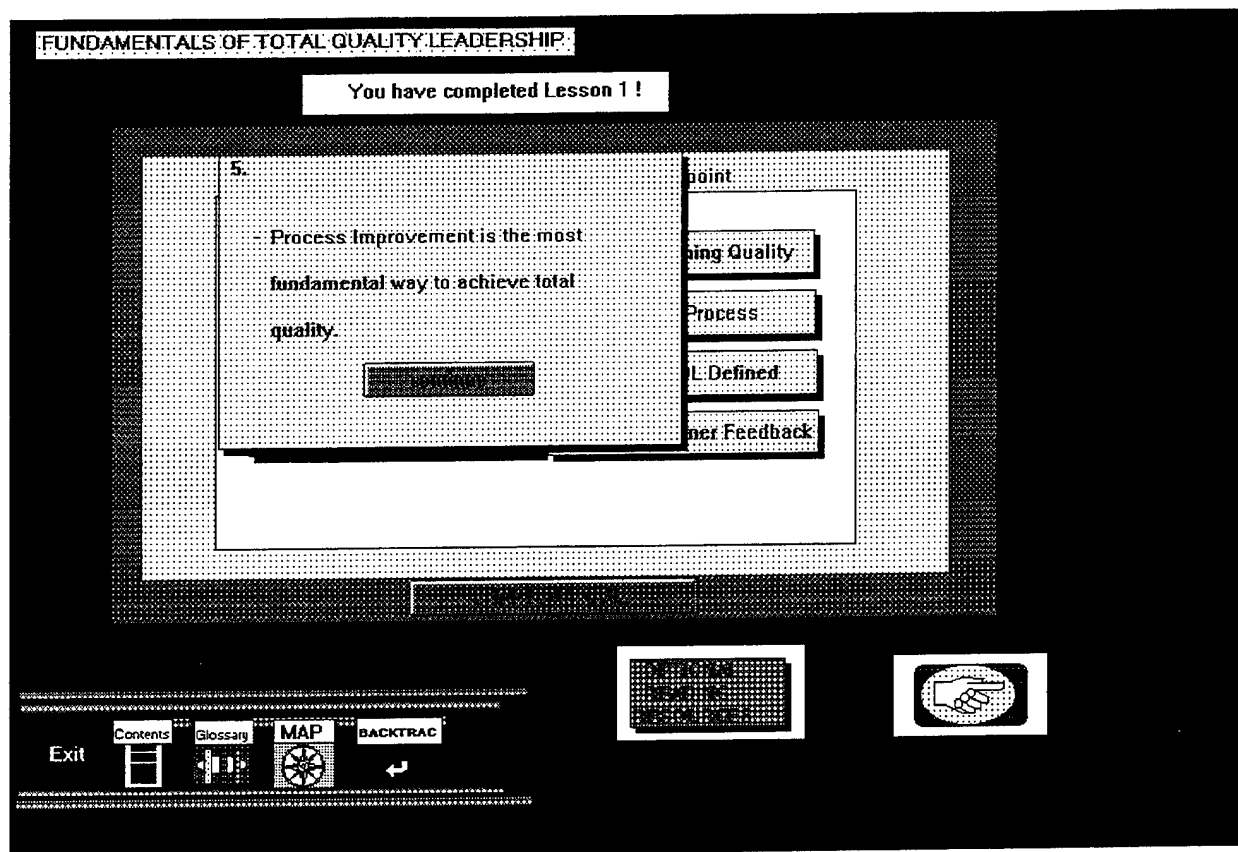


Figure 105 "Review 1-1" [storyboard p. 32] [Step 7 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

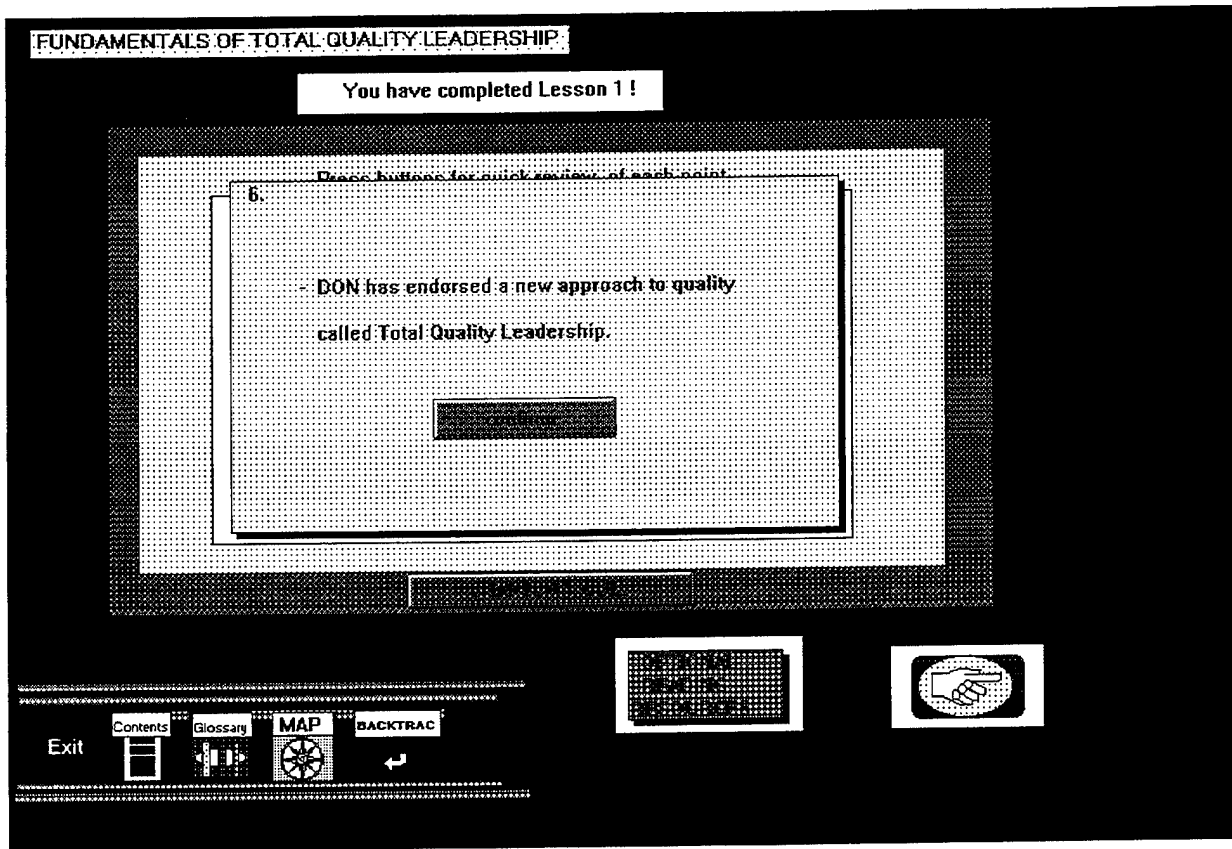


Figure 106 "Review 1-1" [storyboard p. 32] [Step 8 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

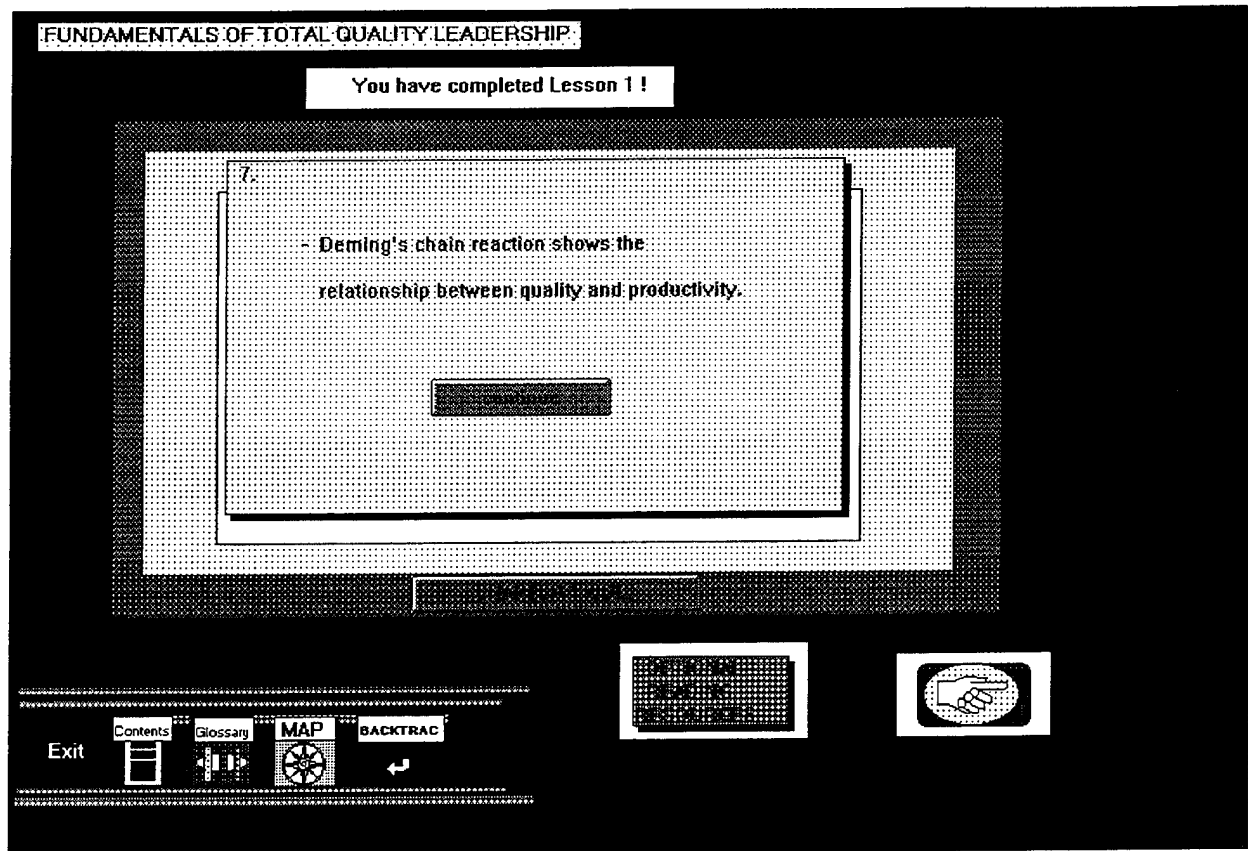


Figure 107 "Review 1-1" [storyboard p. 32] [Step 9 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

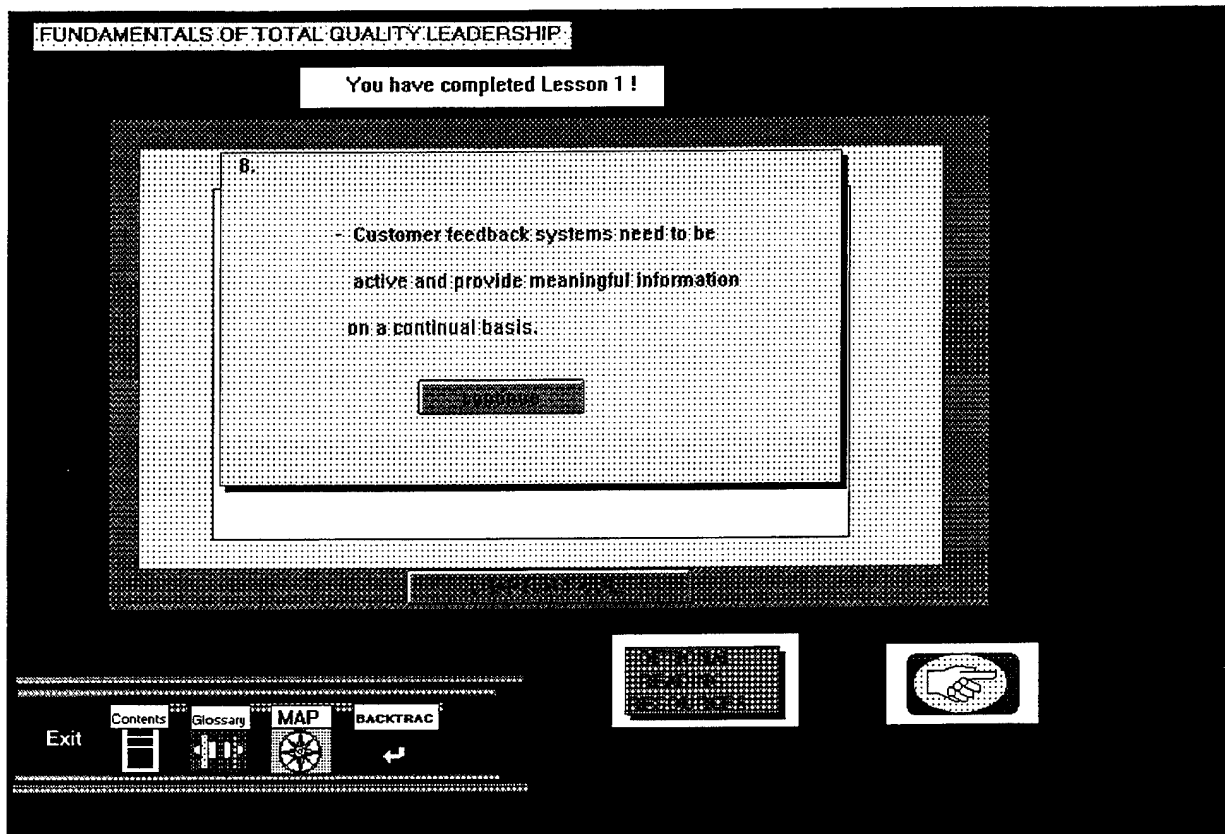


Figure 108 "Review 1-1" [storyboard p. 32] [Step 10 of 10]

Each point is a button that displays information pertaining to the subject as review.

See steps 3 -10

"Chapter 1 Quiz" to "Quiz" [storyboard p. 78]

"Optional Reading Resources" to "Optional Reading" [storyboard p. 59]

"Continue" to "Lesson 2 Choice" [storyboard p. 58]

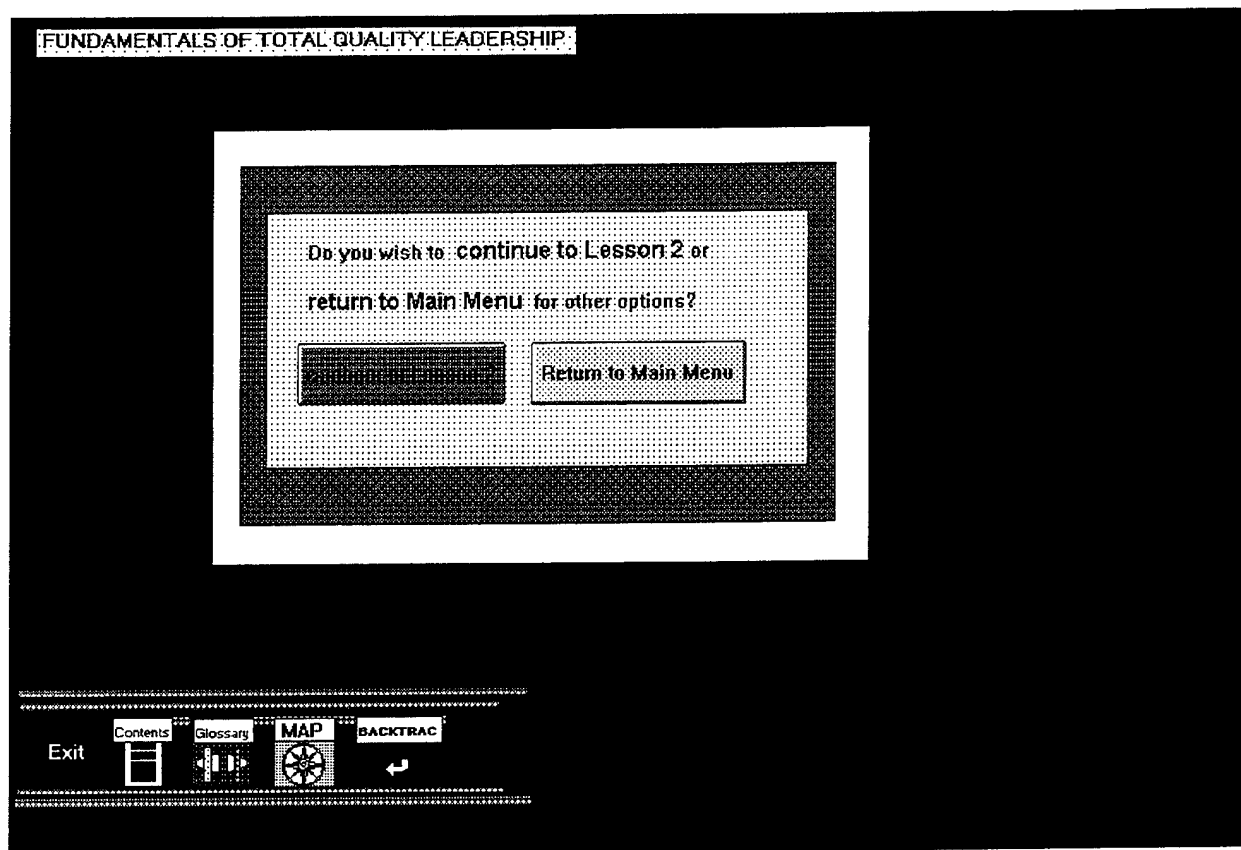


Figure 109 "Lesson 2 Choice" [storyboard p. 58]

"Continue to Lesson 2" to textbox "Under Construction"

"Optional Test" to "Quiz" [storyboard p.78]

"Return to Main Menu" to "Index" [storyboard p. 81]

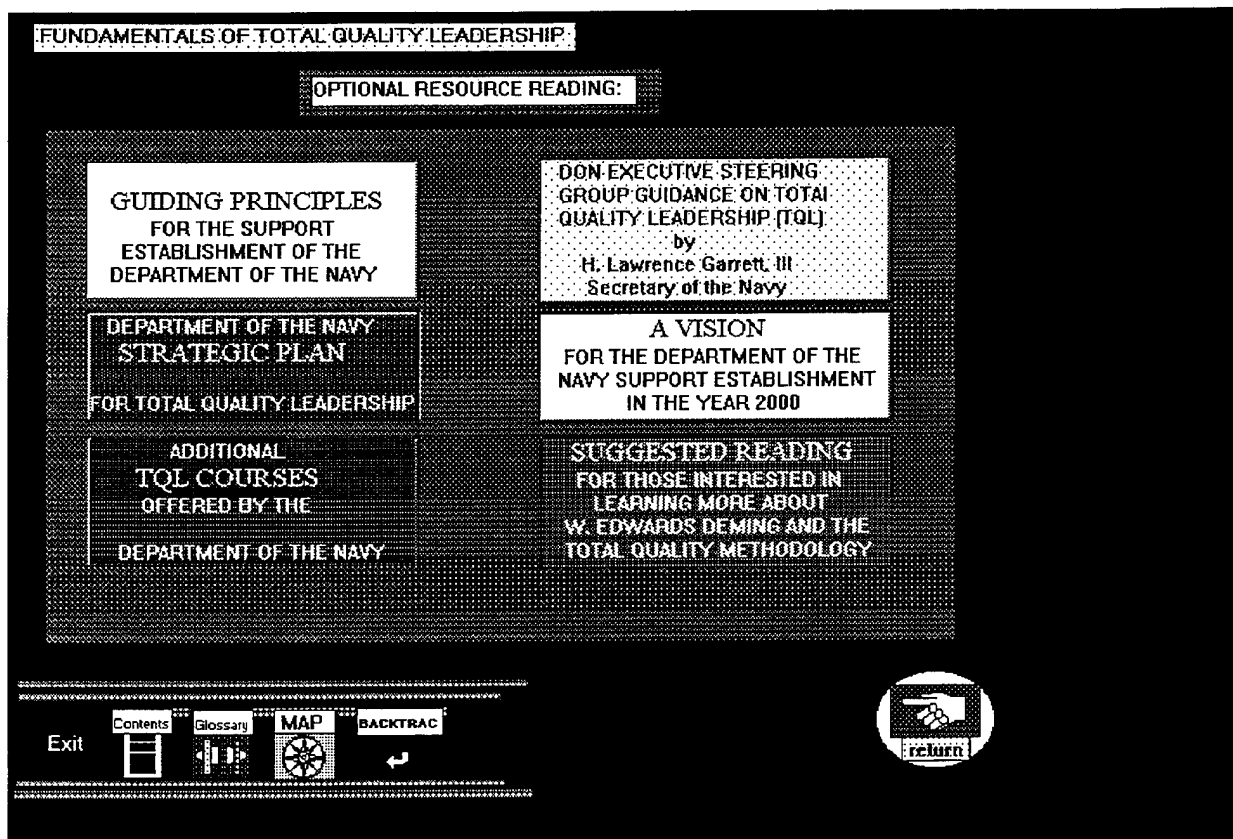


Figure 110 "Optional Reading" [storyboard p. 59]

"Guiding Principles for the Support Establishment of the DoN" still under Construction

"Department of the navy Strategic Plan for TQL" still under Construction

"Additional TQL Courses offered by the Don" still under Construction

"DoN ESC Guidance on TQL by SECNAV" still under Construction

"A Vision for the DoN Support Establishment in the Year 2000" still under Construction

"Suggested Reading for those interested in learning more about W. Edwards Deming and the Total Quality Methodology" still under Construction

"Return" to "Review 1-1" [storyboard p. 32]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP
LESSON 1 TEST

1. Who is considered the Father of Total Quality due to his extensive contributions to Japanese industry? (last name only)
2. Quality is defined by the
3. All work is composed of
4. Quality is defined by the user's perception, context, needs & wants. ☐ True ☐ False
5. The difficulty in defining quality is to translate future needs of the user into _____ characteristics so that product/service can be designed to give satisfaction at a price that the user will pay.

☐ MEASURABLE
 ☐ REALIZABLE

☐ ongoing
☐ understandable
☐ perceptive
☐ current
7. TQL is the application of quantitative methods and the knowledge of people to assess and improve materials and services supplied to the organization, all significant processes within the organization, and meeting the needs of the end-user, now and in the future.

☐ True
 ☐ False
8. Deming's _____ shows the relationship between quality and productivity.

Exit
Contents
Glossary
MAP
BACKTRACK

STOP TEST - RETURN
TEST COMPLETED

Figure 111 "Quiz" [storyboard p. 78] [Step 1 of 5]

The Quiz (completed for Lesson 1 only at this time) consists of 8 questions and requires the student to enter a word, decide whether a statement is true or false, or to choose from multiple choice answers. If an incorrect answer is entered, the student will be given the opportunity to "Retry", "Cancel", or "Review". If the student chooses to "review", then each question displays a review statement relating the subject to the question and allows the student to enter another answer. If the student takes the time to review and enters the correct answer on retry, then the previously entered incorrect answers are discounted. In this way, the student is coached and given plenty of time to understand the terms in this crucial introductory chapter. [See steps 2 - 5 for examples of displayed information]

"Test Completed" to "Test Review" [storyboard p. 77]

"Stop Test" to "Course Summary" [storyboard p. 57]

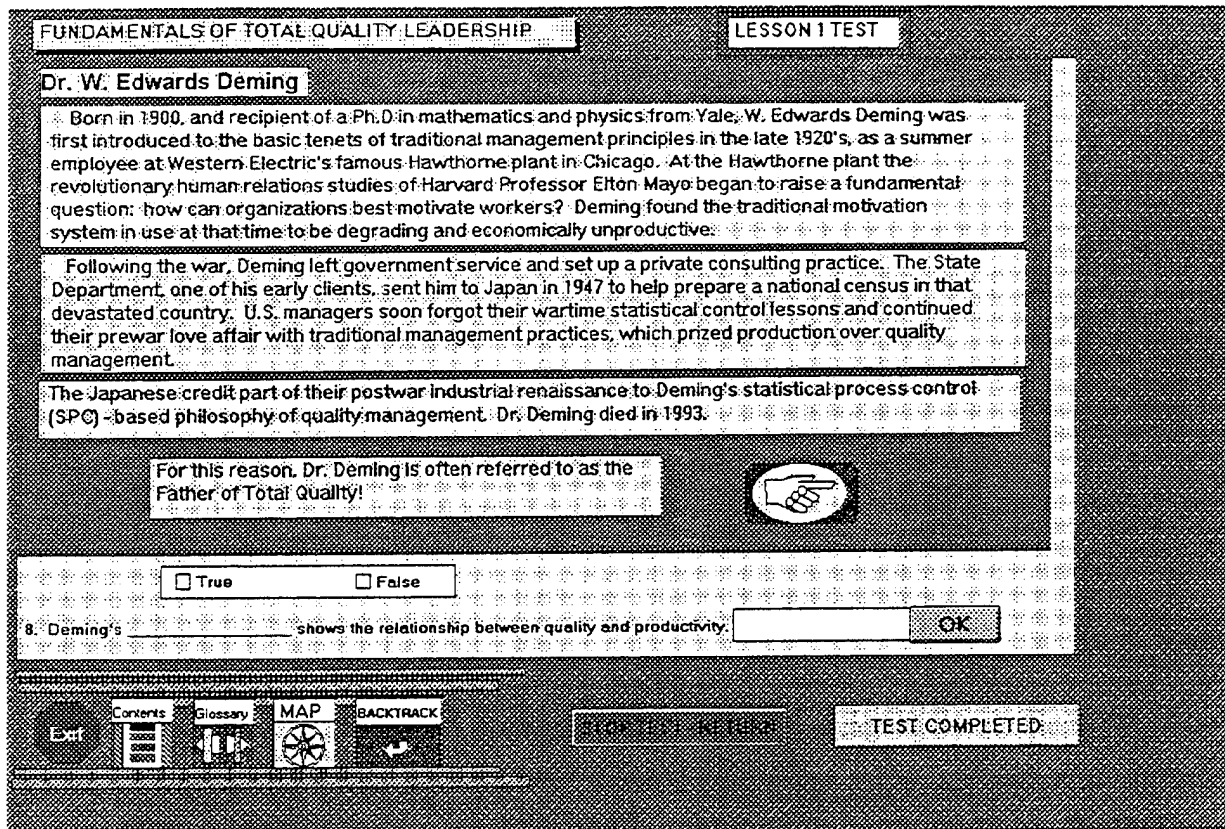


Figure 112 "Quiz" [storyboard p. 78] [Step 2 of 5]

Deming textblock is displayed in answer to Question 1.

The Quiz (completed for Lesson 1 only at this time) consists of 8 questions and requires the student to enter a word, decide whether a statement is true or false, or to choose from multiple choice answers. If an incorrect answer is entered, the student will be given the opportunity to "Retry", "Cancel", or "Review". If the student chooses to "review", then each question displays a review statement relating the subject to the question and allows the student to enter another answer. If the student takes the time to review and enters the correct answer on retry, then the previously entered incorrect answers are discounted. In this way, the student is coached and given plenty of time to understand the terms in this crucial introductory chapter. [See steps 2 - 5 for examples of displayed information]

"Test Completed" to "Test Review" [storyboard p. 77]

"Stop Test" to "Course Summary" [storyboard p. 57]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP
LESSON 1 TEST

1. Who is considered the Father of Total Quality due to his extensive contributions to Japanese industry? OK (last name only)
2. Quality is defined by the customer.
3. All quality is defined by the customer.
4. Quality may be influenced by many factors throughout the customer's overall acquisition, ownership, and product or service experiences.
5. The quality of a product is determined by the customer's overall acquisition, ownership, and product or service experiences.
6. The quality of a product is determined by the customer's overall acquisition, ownership, and product or service experiences.
7. TQL is the application of quantitative methods and the knowledge of people to assess and improve materials and services supplied to the organization, all significant processes within the organization, and meeting the needs of the end-user, now and in the future.

☐ current
8. Deming's _____ shows the relationship between quality and productivity. OK

Exit
Contents
Glossary
MAP
BACKTRACK

STOP TEST - RETURN
TEST COMPLETED

Figure 113 "Quiz" [storyboard p. 78] [Step 3 of 5]

Customer textblock is displayed in answer to Question 2.

The Quiz (completed for Lesson 1 only at this time) consists of 8 questions and requires the student to enter a word, decide whether a statement is true or false, or to choose from multiple choice answers. If an incorrect answer is entered, the student will be given the opportunity to "Retry", "Cancel", or "Review". If the student chooses to "review", then each question displays a review statement relating the subject to the question and allows the student to enter another answer. If the student takes the time to review and enters the correct answer on retry, then the previously entered incorrect answers are discounted. In this way, the student is coached and given plenty of time to understand the terms in this crucial introductory chapter. [See steps 2 - 5 for examples of displayed information]

"Test Completed" to "Test Review" [storyboard p. 77]

"Stop Test" to "Course Summary" [storyboard p. 57]

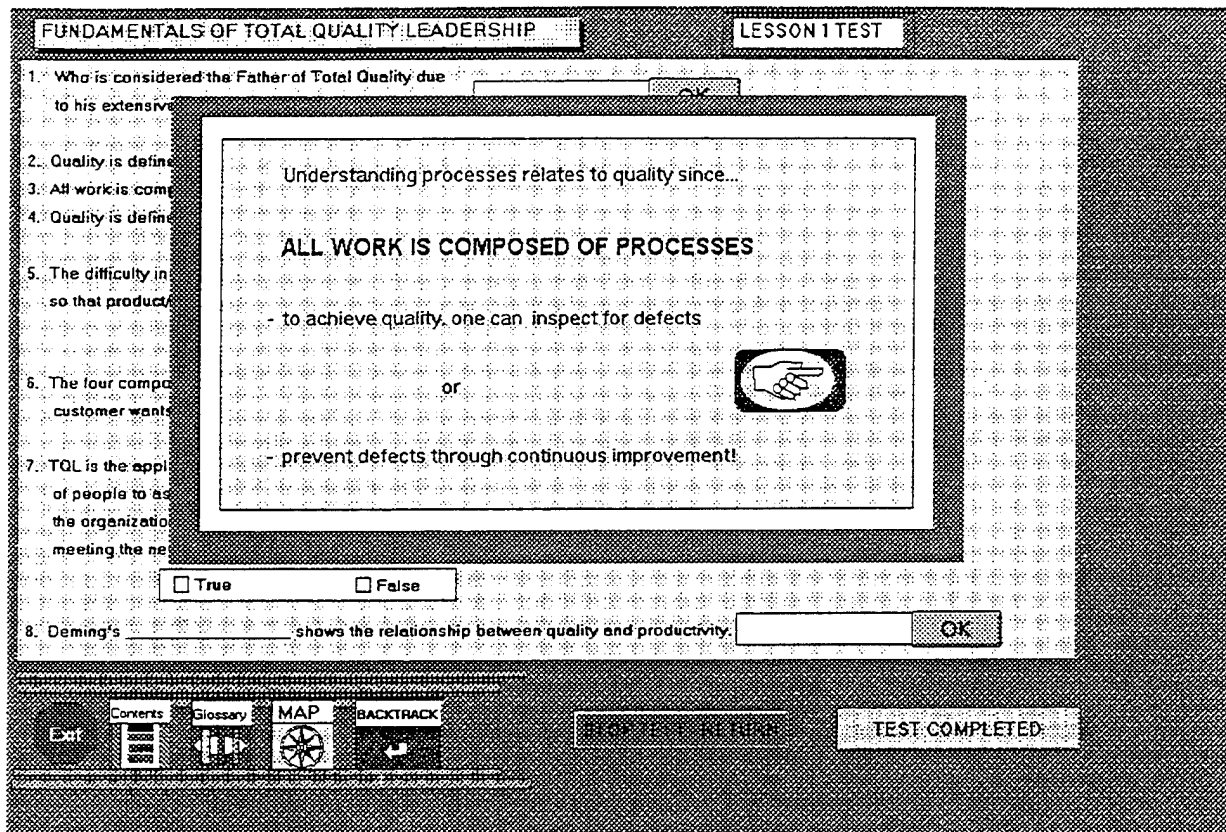


Figure 114 "Quiz" [storyboard p. 78] [Step 4 of 5]

Process textblock is displayed in answer to Question 3.

The Quiz (completed for Lesson 1 only at this time) consists of 8 questions and requires the student to enter a word, decide whether a statement is true or false, or to choose from multiple choice answers. If an incorrect answer is entered, the student will be given the opportunity to "Retry", "Cancel", or "Review". If the student chooses to "review", then each question displays a review statement relating the subject to the question and allows the student to enter another answer. If the student takes the time to review and enters the correct answer on retry, then the previously entered incorrect answers are discounted. In this way, the student is coached and given plenty of time to understand the terms in this crucial introductory chapter. [See steps 2 - 5 for examples of displayed information]

"Test Completed" to "Test Review" [storyboard p. 77]

"Stop Test" to "Course Summary" [storyboard p. 57]

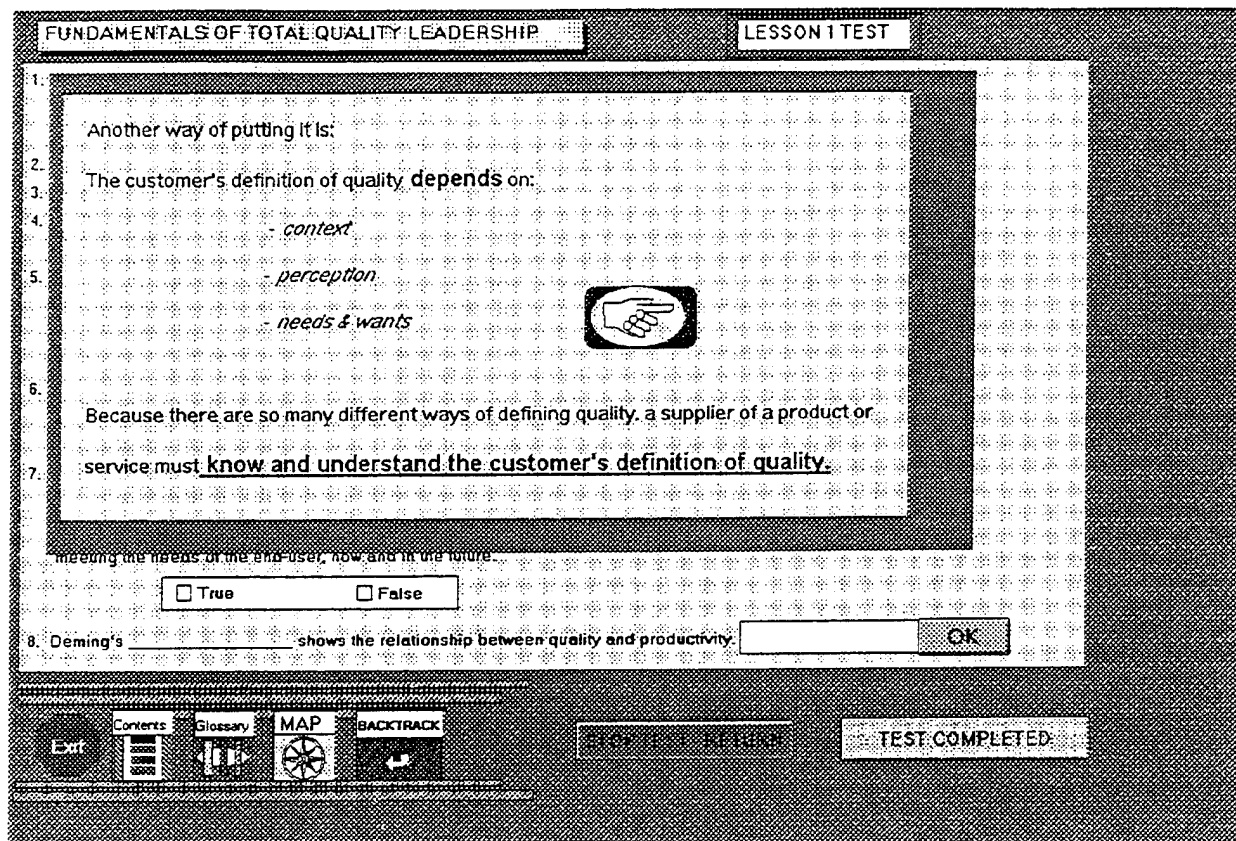


Figure 115 "Quiz" [storyboard p. 78] [Step 5 of 5]

Quality Depends textblock is displayed in answer to Question 4.

The Quiz (completed for Lesson 1 only at this time) consists of 8 questions and requires the student to enter a word, decide whether a statement is true or false, or to choose from multiple choice answers. If an incorrect answer is entered, the student will be given the opportunity to "Retry", "Cancel", or "Review". If the student chooses to "review", then each question displays a review statement relating the subject to the question and allows the student to enter another answer. If the student takes the time to review and enters the correct answer on retry, then the previously entered incorrect answers are discounted. In this way, the student is coached and given plenty of time to understand the terms in this crucial introductory chapter. [See steps 2 - 5 for examples of displayed information]

"Test Completed" to "Test Review" [storyboard p. 77]

"Stop Test" to "Course Summary" [storyboard p. 57]

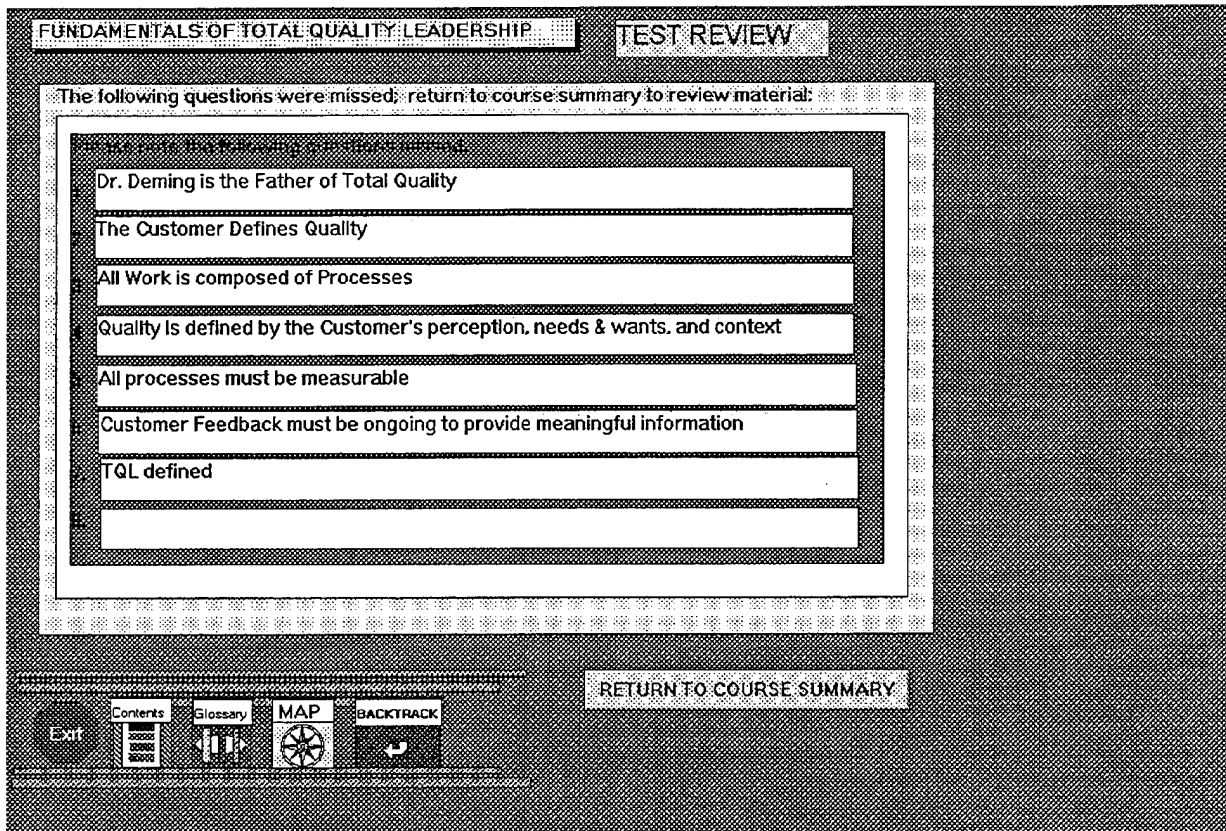


Figure 116 "Test Review" [storyboard p. 77] [Step 1 of 2]

The Test Review toolbook page displays statements reflecting the correct answers to questions missed on the test [step 1] or displays "Congratulations! Your answers were all correct!" if all test questions were answered properly [see step 2]
"Return to Course Summary" to "Course Summary" [storyboard p. 57]

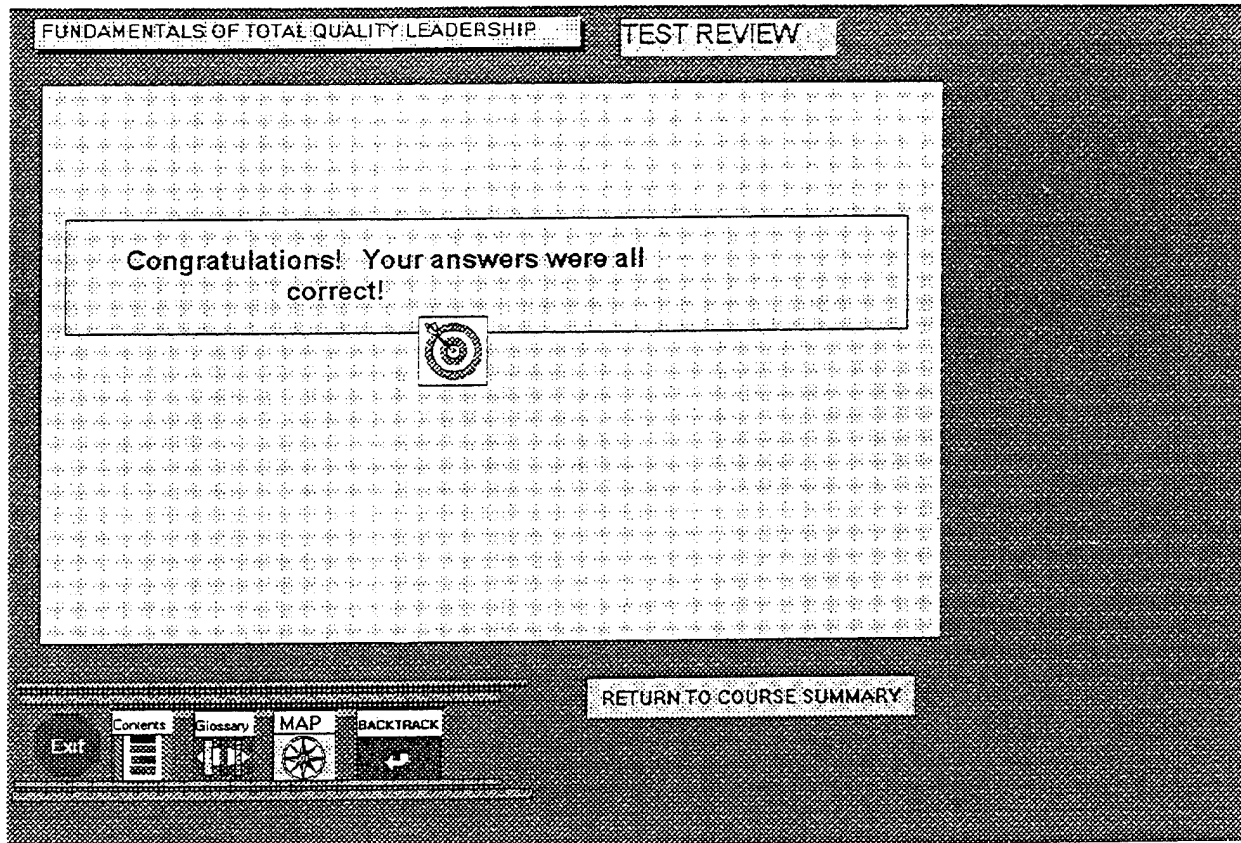


Figure 117 "Test Review" [storyboard p. 77] [Step 2 of 2]

The Test Review toolbook page displays statements reflecting the correct answers to questions missed on the test [step 1] or displays "Congratulations! Your answers were all correct!" if all test questions were answered properly [see step 2]

"Return to Course Summary" to "Course Summary" [storyboard p. 57]

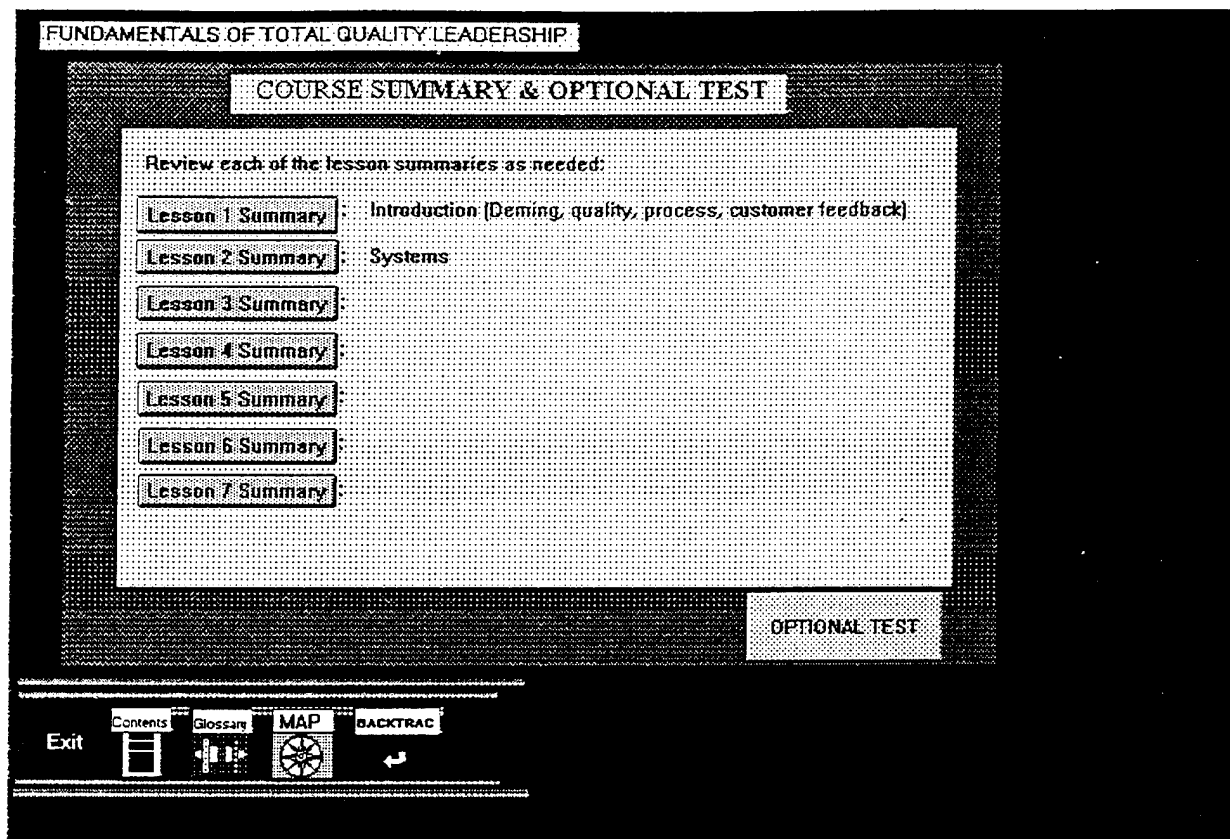


Figure 118 "Course Summary" [storyboard p. 57]

"Lesson 1 Summary" to "Review 1-1" [storyboard p. 32]

"Lesson 2 Summary" still under construction

"Lesson 3 Summary" still under construction

"Lesson 4 Summary" still under construction

"Lesson 5 Summary" still under construction

"Lesson 6 Summary" still under construction

"Lesson 7 Summary" still under construction

"Optional Test" to "Quiz" [storyboard p. 78]

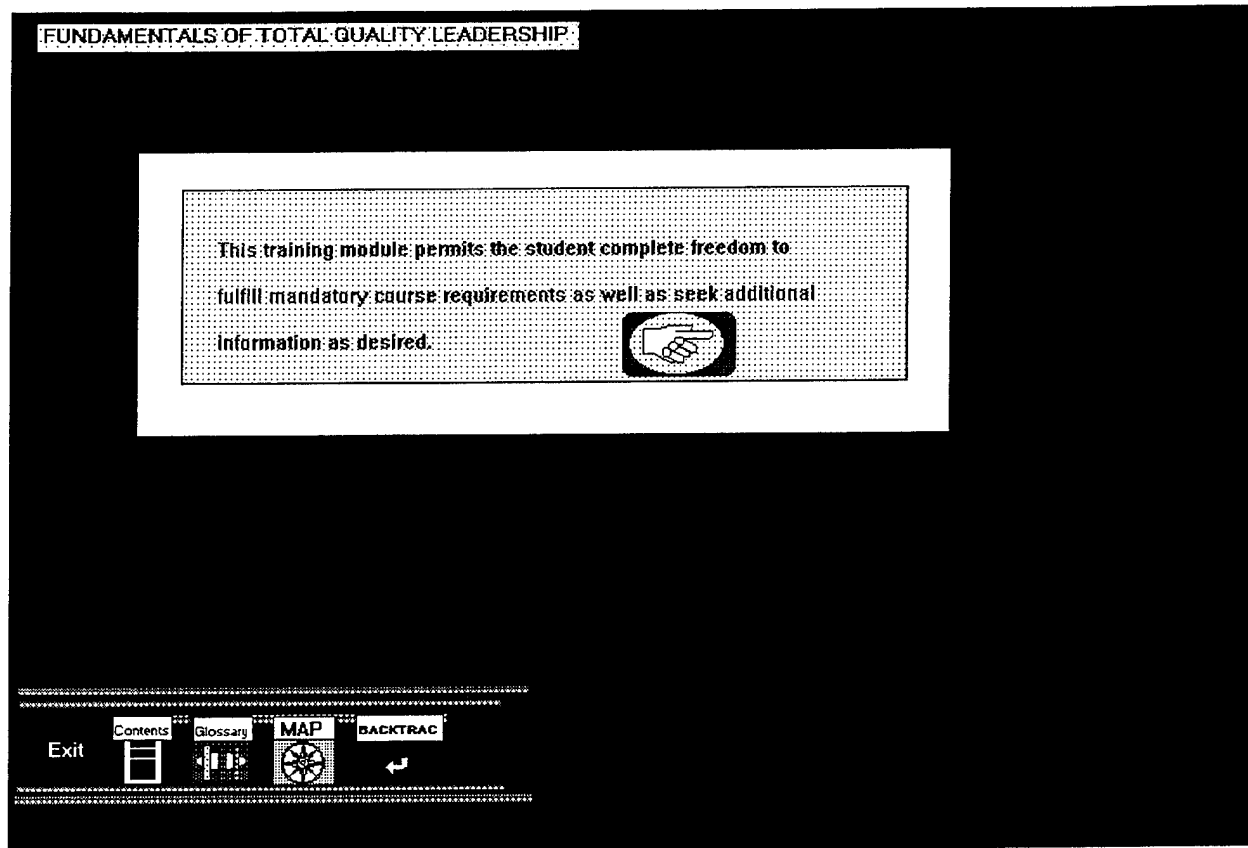


Figure 119 "How to Use this Book" [storyboard p. 80] [Step 1 of 7]

This toolbook instructs the student on the meaning of the navigational buttons (lower left side of screens)

"Continue" to "How to Use this Book" [storyboard p. 80] [Step 2 of 7]

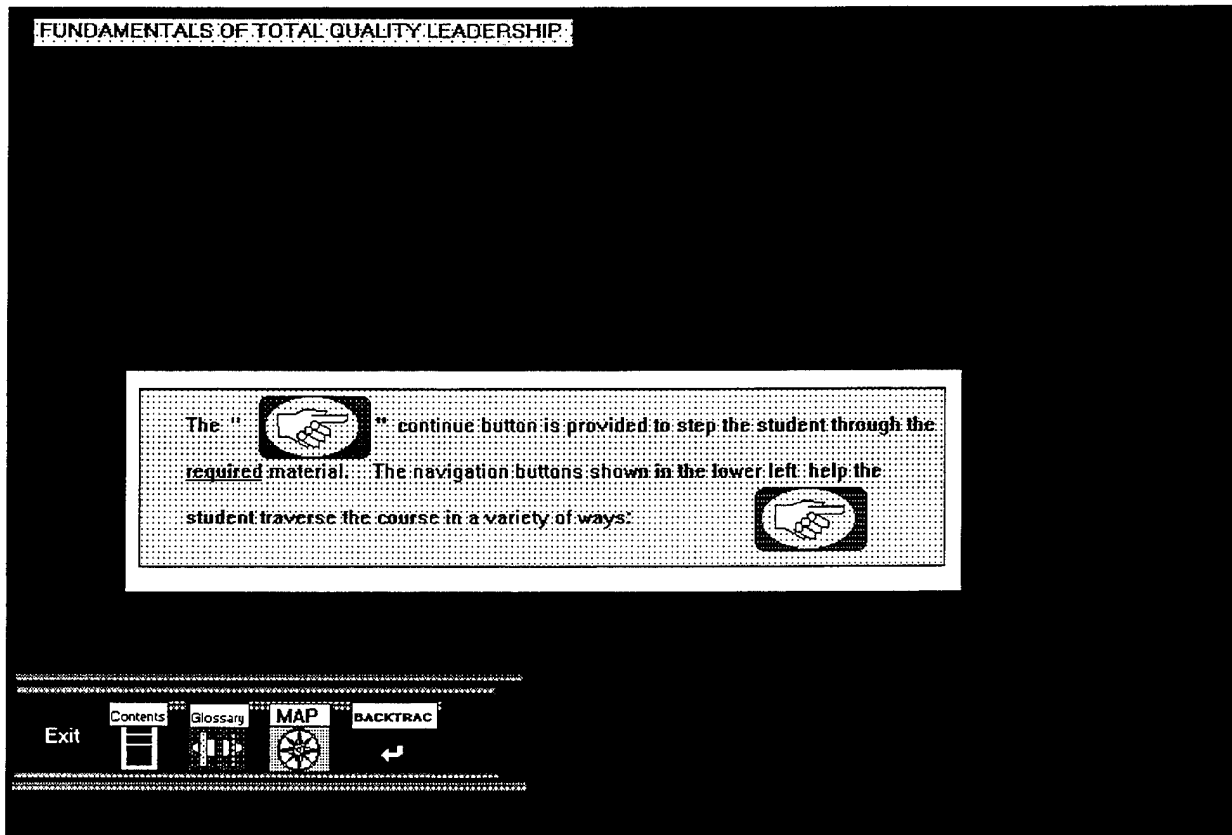


Figure 120 "How to Use this Book" [storyboard p. 80] [Step 2 of 7]

"Continue" to "How to Use this Book" [storyboard p. 80] [Step 3 of 7]

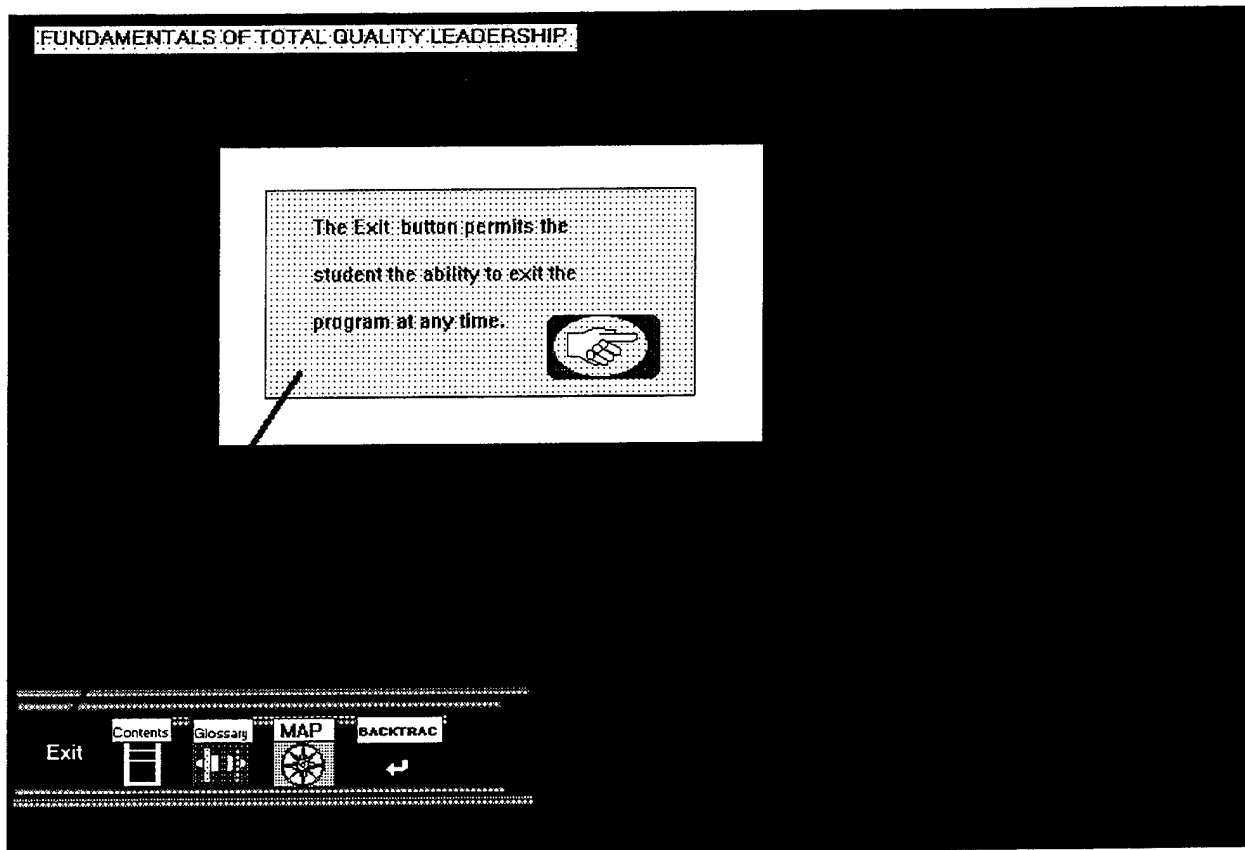


Figure 121 "How to Use this Book" [storyboard p. 80] [Step 3 of 7]

"Continue" to "How to Use this Book" [storyboard p. 80] [Step 4 of 7]

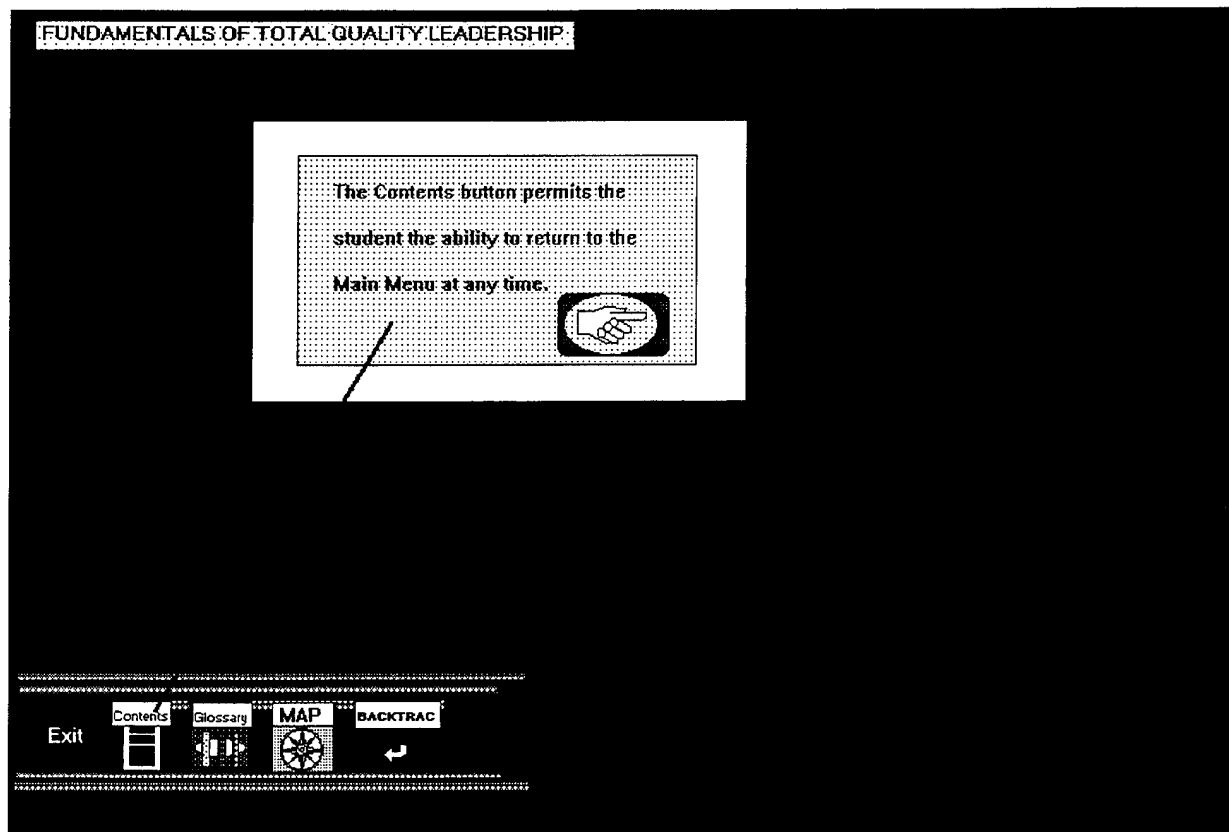


Figure 122 "How to Use this Book" [storyboard p. 80] [Step 4 of 7]

"Continue" to "How to Use this Book" [storyboard p. 80] [Step 5 of 7]

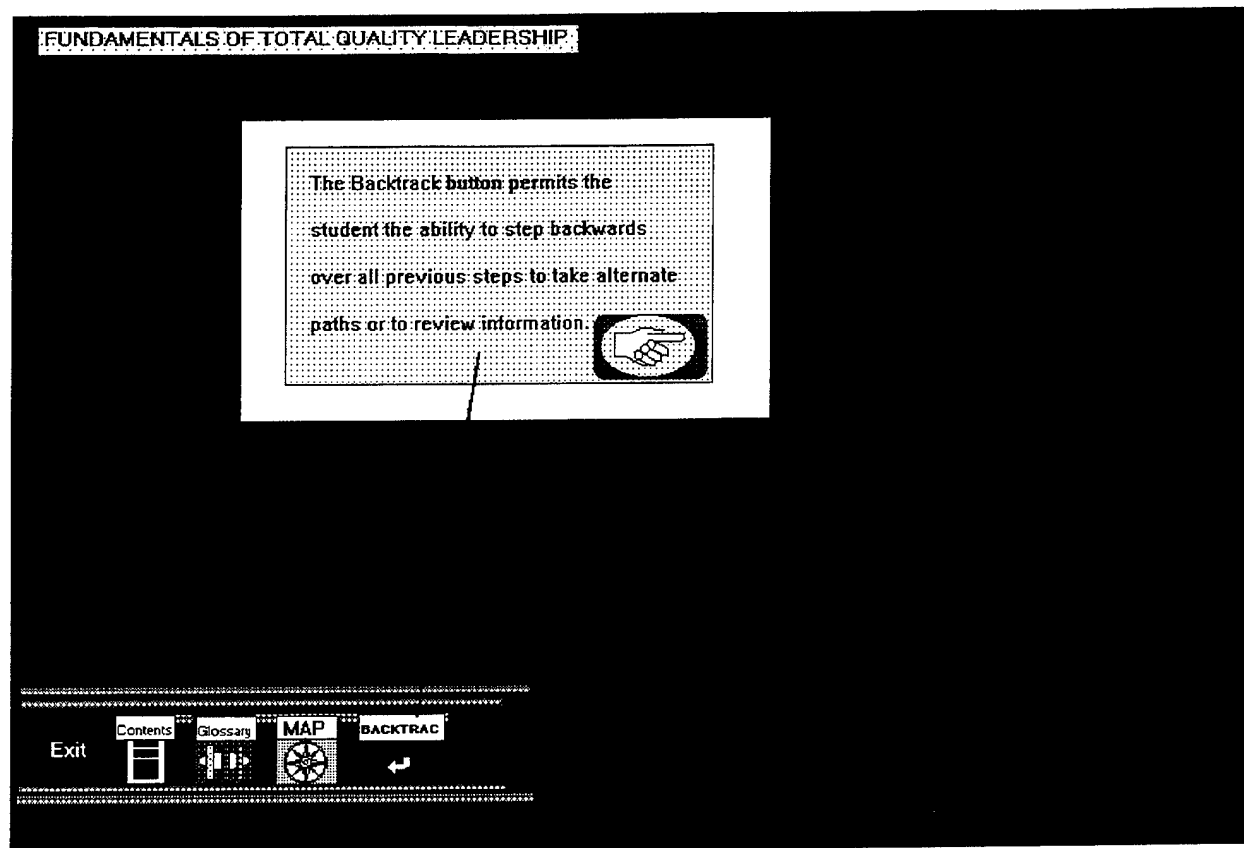


Figure 123 "How to Use this Book" [storyboard p. 80] [Step 5 of 7]

"Continue" to "How to Use this Book" [storyboard p. 80] [Step 6 of 7]

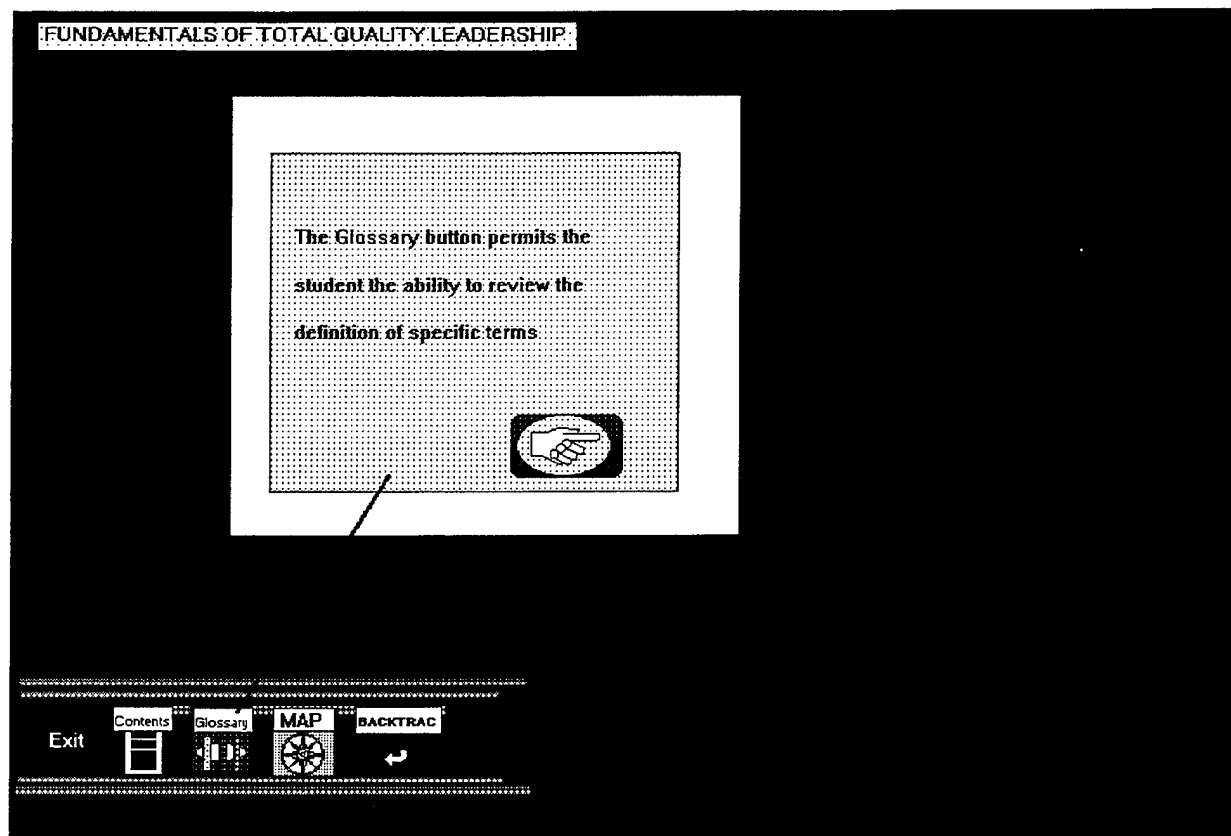


Figure 124 "How to Use this Book" [storyboard p. 80] [Step 6 of 7]

"Continue" to "How to Use this Book" [storyboard p. 80] [Step 7 of 7]

FUNDAMENTALS OF TOTAL QUALITY LEADERSHIP

The Map button permits the student the ability to find where they are with respect to the course material and to jump anywhere else that may be desired at any time.



Exit



Figure 125 "How to Use this Book" [storyboard p. 80] [Step 7 of 7]

"Continue" returns to "Welcome" [storyboard p. 1]

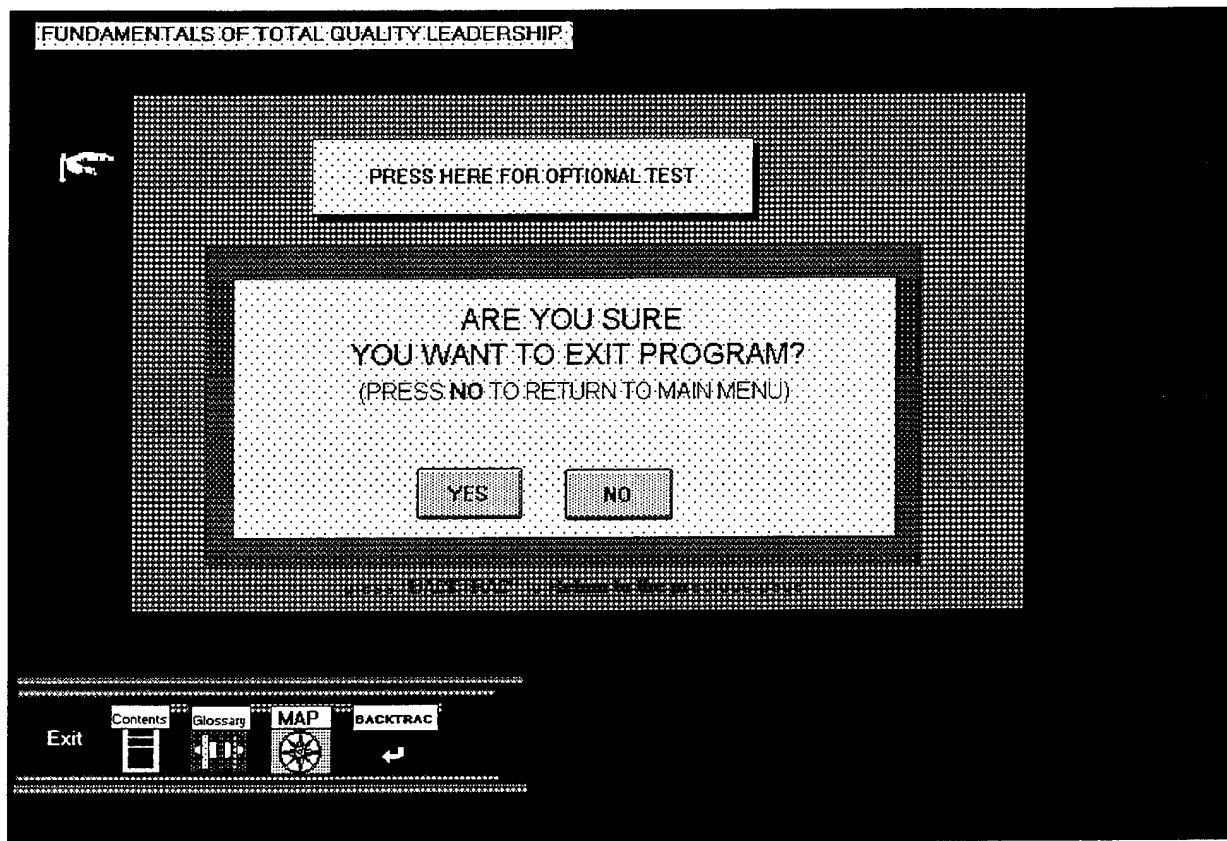


Figure 126 Navigational Button "Exit Choice" [storyboard p. 51]

"Yes" to "Welcome" [storyboard p. 1]

"No" to "Index" [storyboard p. 81]

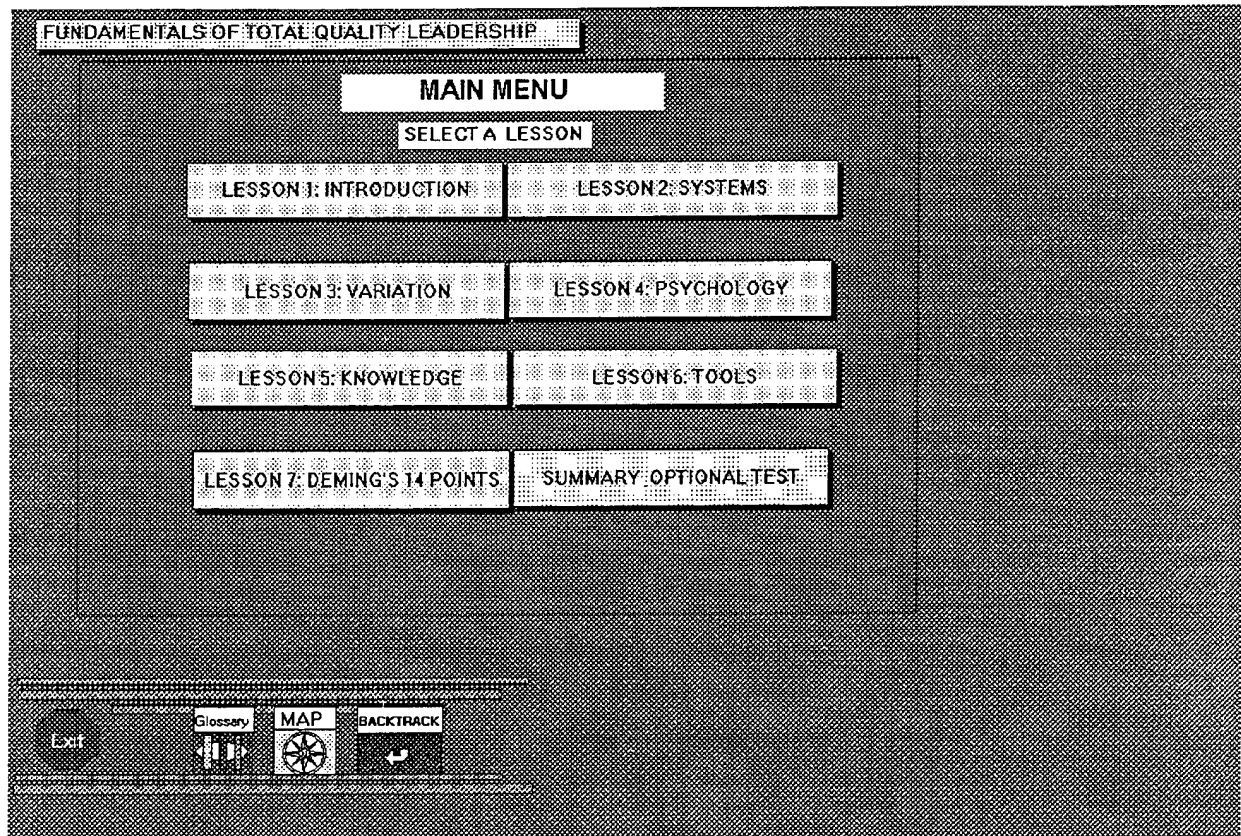


Figure 127 Navigational Button "Contents" [storyboard p. 81]

"Lesson 1: Introduction" to "Lesson1Obj" [storyboard p. 2]

"Lesson 2: Systems" still under Construction

"Lesson 3: Variation" still under Construction

"Lesson 4: Psychology" still under Construction

"Lesson 5: Knowledge" still under Construction

"Lesson 6: Tools" still under Construction

"Lesson 7: Deming's 14 Points" still under Construction

"Summary & Optional Test" to "Course Summary" [storyboard p. 57]

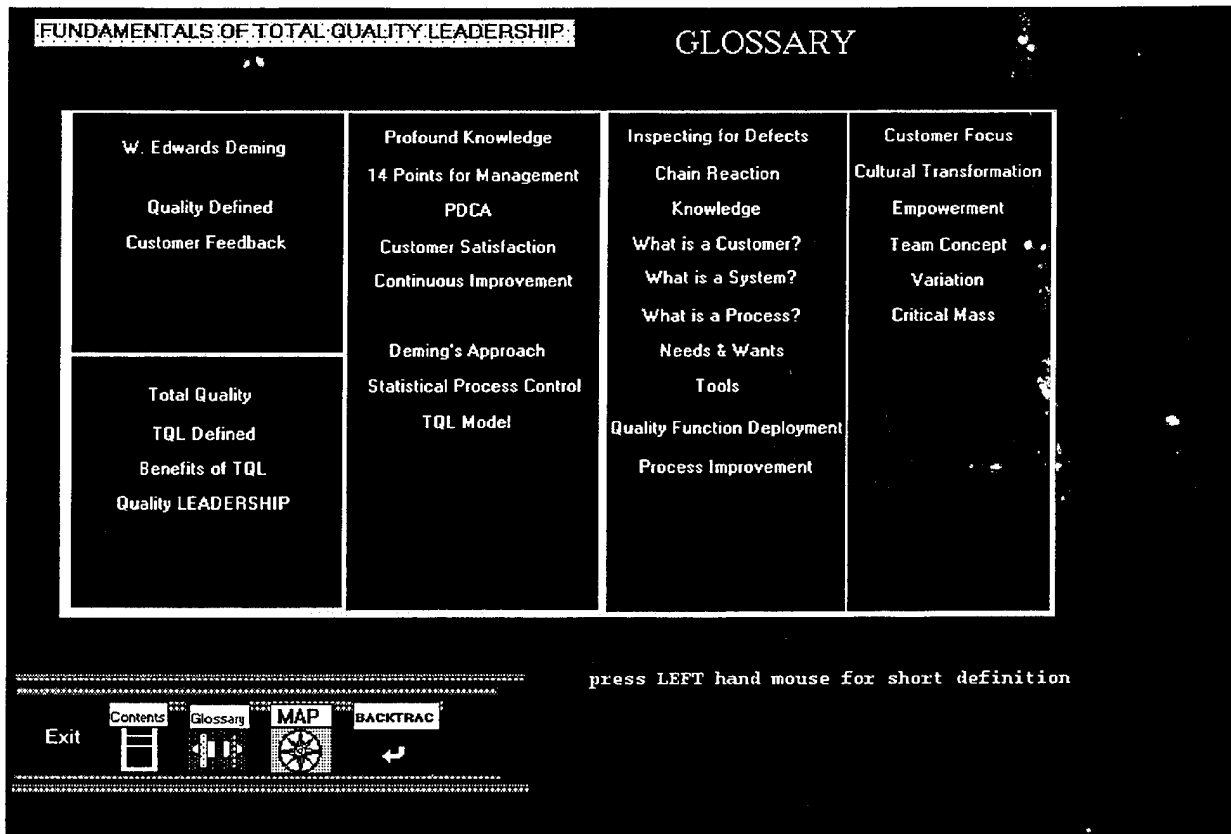


Figure 128 Navigational Button "Glossary" [storyboard p. 82]

This toolbox page displays textboxes containing information pertaining to the term chosen.

Many of the selections on this page are still under Construction

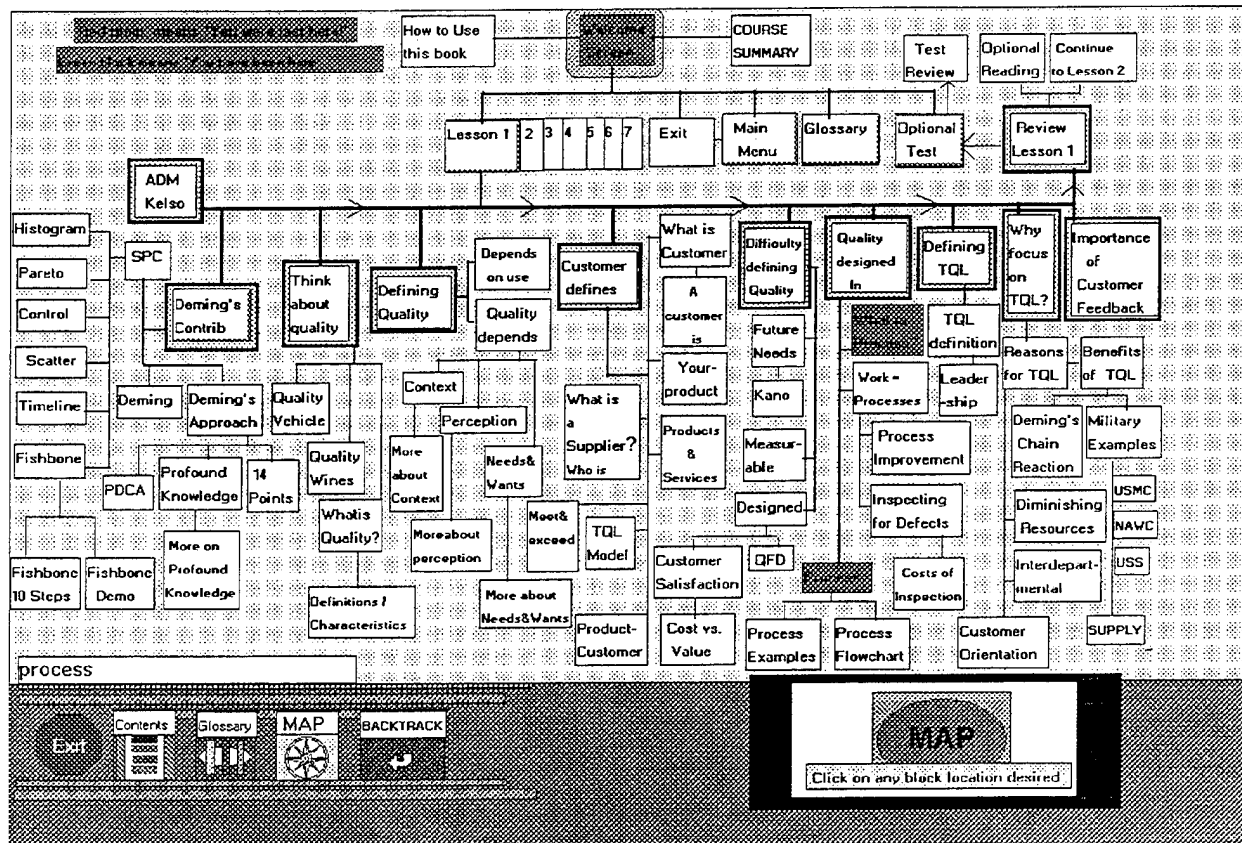


Figure 129 Navigational Button "Map" [storyboard p. 79]

This toolbook page contains buttons on top of textboxes which relate to all the pages in this prototype (primarily Lesson 1 material). The buttons provide the option for the student to go to any page immediately. The textboxes are represented by different colors (white: if the student has not reviewed the material; green: if the student has reviewed the material; red: the page the student left prior to selecting the "Map" option).

The "Map" permits the student to see exactly which material he/she has already reviewed, which material remains to be reviewed, and the option to go immediately anywhere in the lesson....forward or backward.

See next page for list of Storyboard page numbers and page titles

LIST OF STORYBOARD PAGES

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| Storyboard Page# | Page Title | Storyboard Page# | Page Title |
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| 84 | DoN Strategic Plan | | |
| 85 | Additional Courses | | |
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| 89 | Developer's screen | | |
| 90 | Developer's screen | | |

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